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VOLUME XIII SEPTEMBER 22, 1924 NUMBER 16

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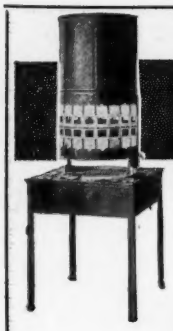

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VOLUME XIII NEW YORK, SEPTEMBER 22, 1924 NUMBER 16

The New Science of Colors

Previous Status of the Science of Colors—Measurement of the Gray Colors—Method of Indicating Gray Colors by Use of Scale—Gray Standards and Gray Harmonies

By WILHELM OSTWALD

Translated and Abridged by Albert P. Sachs, Technical Director, Universal Trade Press Syndicate

[EDITOR'S NOTE.—*This translation is the third article on the Ostwald Color Theory that has been published in the* AMERICAN DYESTUFF REPORTER, *and with the other two forms a fairly complete discussion of the subject. For those who may desire to reread the others we give the references as follows: Classifying and Measuring Color by the Ostwald Method, by H. T. Tenen; Vol. 12, No. 4, page 127. A Simplified Method of Applying the Ostwald Color Theory, by Ismar Ginsberg, B. Sc., Chem. Eng.; Vol. 12, No. 23, page 809.*]

WHILE arrangement, pitch and harmony of sound tones have been known since the time of Pythagoras—that is to say, for 2,500 years—it has been necessary to wait until the present time to organize our knowledge of colors to a similar extent. And yet the world of the eye is much more important, much more comprehensive, than the world of the ear. The reason lay not in the lack of interest but in the much greater difficulty of the problem. All tones form a simple series from the lowest to the highest, which permits representation by a straight line so that every tone can be co-ordinated with a fixed point corresponding to its pitch. If the attempt is made to arrange colors in a similar way, one soon learns that the attempt is fruitless. Every catalogue of coloring matters, dyed textiles, colored paper, etc., proves by the lack of rational arrangement that this problem of prime importance for every producer or consumer of dyestuffs or colored products has not heretofore been solved, in spite of the pressing necessity for a solution. What is the reason for this?

It lies in the fact that the arrangement of colors is much more complicated than that of tones or numbers. The world of colors is not *uni*dimensional, like that of tones, numbers, lengths and most other measurable magnitudes, but is *tri*dimensional, like space. It is just as impossible to arrange in a series all the colors which occur in nature or which man has prepared as it is to arrange all the points of a given space in a series. And just as it is necessary, in order to define a point in space, to describe three magnitudes—namely, its three co-ordinates—so it is necessary to give three magnitudes (hue, white content, black content) in order rigidly to define color.

Newton made the first step in arranging the colors when he arranged the colors of the spectrum in a *circle* which had to be completed by the addition of purple, which does not occur in the spectrum. But this method does not at all include the complete range of colors but only the *pure* or *saturated* colors, which we shall later name *full-colors.* Pure red and yellow, green and blue occur in the spectrum, but not the countless array of derived colors, like pink, olive-green, gray-blue, khaki-yellow, etc. The color circle arranges the colors according to *one* of their properties, which we shall call the *hue;* the other properties which exercise the profoundest influence on the appearance of the colors are left completely out of consideration.

The fundamental recognition that the totality of colors or "color body" has three dimensions is not very old; it was first discovered by Tobias Mayer, of Goettingen, in 1745. Johann Lambert gave a more complete description at Berlin in 1772. Both arranged the colors in a three-sided pyramid. The painter Philipp Otto Runge, of Hamburg, attained an important advance in 1809 when he arranged the world of colors in the form of a sphere, with white and black at the poles and the pure or full colors at the equator. Investigation in the qualitative era before the present time did not advance beyond this step. Especially the much admired arrangement of Chevreul represents a definite retreat from the work of Runge. But, on the other hand, Chevreul accomplished a great deal in the practical description of the various possible colors.

Modern science has done but little toward the solution

of this problem. It is not too much to say that it has hindered the solution. For instance, Helmholtz proposed, as the three co-ordinates of the world of colors, hue, purity, and brightness, from which no rational system of color bodies can be built up. That hue, white and black are the correct three co-ordinates had already been shown by Mayer, Lambert and Runge, as by means of these co-ordinates they had attained the color body. But the great authority of Helmholtz permitted their discovery to remain in the background, although E. Hering again called attention to the correct elements of colors. So at the end of the nineteenth century the distinguished investigator of colors Ogden N. Rood, of New York, was compelled to admit: "In point of fact, our knowledge of color and our means of experimenting on it are not at present sufficiently advanced to enable us even to propose a plan for a truly philosophical classification, and between the proposal and its execution there would be many weary steps."

Measurement of the Gray Colors

The immediate present has brought a change. Our knowledge of colors and of the means for experimentation is sufficiently developed not only to permit the proposal of a truly philosophical classification but also to carry it out. And the many weary steps to its execution have been traveled so that mankind now possesses a complete map of the world of colors as it has at its disposal a map of the earth's surface.

How has this advance become possible?

By making colors *measureable*.

So long as we cannot measure a magnitude we cannot arrange it finally even if we know its sequence. For example, we are quite clear as to the sequence of hues in colors; we know that yellow, orange, red, violet, ultramarine-blue, ice-blue, sea-green, leaf-green follow each other in the series and that this order is just as determined as that of pearls loosely arranged in a graduated string. But just as we can slip the pearls up and down the string, arranging them more closely or more loosely, just so can we arrange the hues in the circle more closely here and more loosely there, and also differently at will, and we have no basis for determining which arrangement should be chosen as final. Only if we can express the intervals between the given hues quantitatively—that is to say, if we can *measure* them—are we able to arrange them so that equal differences of hue correspond to equal angles in the circle; this arrangement is final and unchangeable.

Similarly we are certain that all gray colors may be arranged in a series between white and black, just as all notes may be arranged from the lowest to the highest. But again, a final arrangement is possible only on the basis of measurements.

Here we may see the possibility of a solution of the problem. We may define as the whitest white a surface which completely reflects all incident light and at the same time scatters it in all directions. And it is known that a layer of chemically pure barium sulphate of sufficient thickness (3 mm. or more) possesses this property to within less than 1 per cent. And it is also known that a small opening in a box which is coated deeply with black on the inside shows a perfect black from which no measurable quantity of light proceeds. It now becomes a simple problem of photometry to determine for any given gray surface how large is the fraction of light in comparison to barium sulphate which it reflects. If this amounts, for instance, to a third of the light which is reflected by the barium sulphate surface under similar circumstances, then this gray color has a value of 0.33 and is thereby completely defined. It may always be determined again or reproduced.

It is remarkable that in the previous science of colors this obvious possibility was overlooked, although for more than one hundred years it was evidently available. It is not known to me that anyone prepared a series of measured gray colors, although much could have been learned from it. I have used for many years a small gray scale (Fig. 1) with measured intervals,* by means of which I can measure every possible gray, just as length is measured with a yardstick. However, one soon learns to evaluate the intervals by means of the eye alone, so that the scale is required only for more exact measurements.

By this means we are completely at home in the world of gray colors, for every gray is either present as an interval in the scale or it lies between two intervals. We can say by spoken or written word, by telephone or telegraph, which gray we means in a given case. If in the case of a gray object we measure the hue and find it to be interval *i*, all people living now or in the future can see it at a glance or reproduce it and know exactly which color is meant. The gray colors have, in a word, become an integral part of human culture, for we may include therein only whatever may be recorded and transmitted to posterity for use and development.

How are the intervals designated *a, c, e, g, i, l, n, p, r, t* prepared and defined? The answer will lead us very far and will only be indicated here. If we prepare experimentally a gray scale which is provided with the colors 1, 0.9, 0.8, 0.7, 0.6, 0.5, 0.4, 0.3, 0.2, 0.1, 0.0, we see at once that it cannot serve as a means of measurement. The colors 1.0, 0.9, 0.8, 0.7 look very white and can hardly be distinguished, 0.6 is almost white gray, and 0.5, with half white and half black, is a pronounced light gray, as well as 0.4 and 0.3; 0.2 is a medium gray, 0.1 is a gray black, and then comes suddenly the deepest black, 0.0, which is darker than the blackest velvet.

The reason for these facts is based on the law of Weber and Fechner, according to which stimuli must decrease in a geometric series in order that the percep-

*They are identified by the letters a, b, c, etc. For ordinary purposes every other step may be omitted so that the scale contains the intervals a, c, e, g, i, l, n, p, r, t. See further below.

tions may diminish by equal steps. A gray series with the values, 1, 1/2, 1/4, 1/8, 1/16, 1/32, etc., would have this property. As our number system is arranged decimally, it is necessary to arrange the intervals of our gray scale decimally in order that it may be used later as the invariable basis. There are, therefore, between 1 and 0.1 ten members of a geometric series and also ten between 0.1 and 0.01. In practice it is generally not necessary to go further. The middle value of each of these steps has been taken, leading to the following series:*

0.89	0.71	0.56	0.45	0.35	0.28	0.22	0.18	0.14
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
0.11	0.089	0.071	0.056	0.045	0.035	0.028	0.022	
k	*l*	*m*	*n*	*o*	*p*	*q*	*r*	
0.018	0.014	0.011	0.0089	0.0071	0.0056	0.0045		
s	*t*	*u*	*v*	*w*	*x*	*y*		
0.0035								
z								

FIG. 1

Underneath the figures the letters of the alphabet are written. As previously mentioned, for practical purposes we need consider only every other step, as the individual steps are too close to one another. No steps lower than *t* can be represented on paper.

This is the genesis of the small gray scale. As we can see, it can be set up anywhere in the world where the necessary simple photometric measurements can be made. In this respect it has an advantage over the system of lengths or weights. These require for their definition the normal meter or kilogram kept at Paris or Washington, while the steps of the gray scale can be prepared without any such ultimate standard. Its values, therefore, completely warrant the name of *absolute* magnitudes.

However, we shall later require these figures just as little as the musician needs the vibration frequencies of the notes with which he practises his art. They are explained merely to give the reader adequate assurance that in the new science of colors he is dealing with exactly defined and exactly measurable magnitudes. There results, therefore, in the science of colors at the present time the same advance which occurred in chemistry at the beginning of the nineteenth century; namely, the transition from the qualitative epoch to the quantitative. If we stop to consider that the giant upward stride of scientific and practical chemistry begins with this period we can visualize what advances in the science and practice of colors have now become possible and can be accomplished in the immediate future.

*The letter j is not used in Ostwald's alphabet.

GRAY STANDARDS AND GRAY HARMONIES

The steps *a, c, e, g, i, l, n, p, r, t* of the gray scale have been made equidistant for perception on the basis of the Weber-Fechner law; at the same time they correspond to the decimal system which is at the basis of all our numbers and measurements. Hereby they have acquired the property of being able to serve as *standards*.

At this date it is not necessary to prove the value of standardizing magnitudes used in science and technology. As a matter of fact, the steps in the gray scale were chosen with the guiding motive that they should be able to serve as standards. It is not possible to devise a simpler and more rational system of gray standards, for if we employ the basic principles of all standardization consistently to the group of gray colors we will, of necessity, be led to the system described. It is, therefore, highly improbable that it will ever have to be discarded in favor of a better system, and we may use it with full reliance on its permanence.

This means that we can prepare all objects to which we give gray color by choice, housefurnishings and machines, hats and walls, etc., etc., not with a haphazard color as formerly, but with that standard color which most closely approaches the desired color. The steps are chosen close enough together to meet all practical requirements and far enough apart so that we can meet all requirements with a small number, eight or at the most twelve. We require, therefore, only eight to twelve sets of directions for coloring, mixing, etc., and can meet all requirements with them which can possibly be imposed. The manufacturer of finished paints needs to prepare only these colors, and if the consumer requires the gray *g* he need only mention the letter in order to get exactly what he desires.

I hardly need dwell upon the enormous economic and

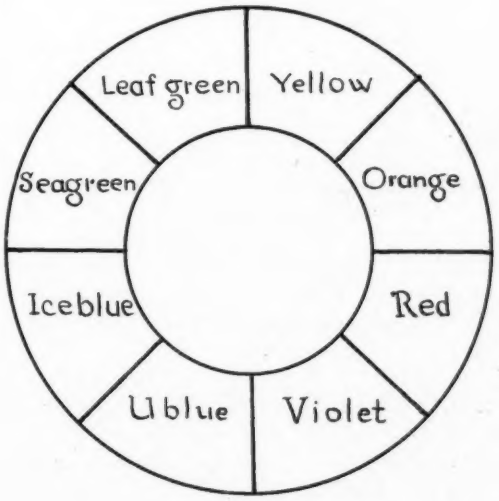


FIG. 2

technical advantages which are bound up with this standardization of gray colors, for they are entirely comparable with the advantages which standardization in the other spheres of industry brings.

But it will not be without advantage to indicate a totally unexpected result of this standardization which increases the scope of this advance immeasurably. It lies in the following:

If we paint an object with several gray colors we observe the following: Combinations like *a, c, e* or *g, l, p* or *c, i, p*—in short, those in which the intervals of the three components are equal—produce an agreeable or harmonious impression. If, however, we take unequal intervals, like *a, c, l* or *g, i, p,* the pleasing impression is missing. If we make ourselves familiar by repeated observation of equally spaced combinations with the impression of the gray harmonies, we will be offended and repelled by unequally spaced combinations; they are felt as dissonances.

We are here making the first step in the always sought and heretofore undiscovered realm of color harmonies. With the steps *a, c, e, g, l, n, p* we can make twelve different equally spaced triads. Since with each triad a pattern can be made up in at least six different ways, there are altogether (6×12) seventy-two different ways of executing the same pattern, all of which are equally spaced. I have made up various patterns in this way and every one was found to be harmonious. An indescribable pleasure is produced in observing such series; every pattern has a character of its own and every one is beautiful in its own way. That such harmonious stimuli can be obtained simply from gray colors has hitherto been unknown. A new realm of beauty has been opened along the road of science, and when women have made a few tests on what charming toilettes can be made up from correctly spaced gray colors this new realm will become known to and treasured by all the rest of mankind.

The key to this discovery lies in the general law that beauty is attained through order and conformity to law. This law is valid throughout all the realms of art, in music as in poetry, in architecture as in the realm of color. The case of the gray harmonies is the first application we make of this first main principle of the philosophy of beauty. Later we shall see that the bright colored harmonies can be determined through the same law.

The gray scale has from this viewpoint a significance similar to the tonal scale in music. By the application of the simple law of equal intervals everyone can henceforth with assurance so combine three or more gray colors that they will affect us truly pleasantly. The production of harmonious combinations depends no longer on a rare, special talent, but anyone can acquire it, just as everyone can learn to produce simple harmonies on the piano.

(*To be continued*)

Mercerization—A Textile Romance

Part I

Discovered by Accident—The Less Valuable Features First Patented—Recognition of Luster and Early Developments in Europe—Transferred to America Where History Repeats Itself—Fortunes Lost in Annulled Patents—Large Part of Cotton Crop Now Mercerized Every Year

By CHARLES F. GOLDTHWAIT

[NOTE.—*The portion of this article covering the history of mercerizing in America was partly drawn from "Twenty-five Years of Mercerizing in the United States" in the 1924 Annual Review Number of Textile World.*]

MERCERIZATION is one of the few revolutionary discoveries in textiles since the invention of power machinery. Credit for the features that have proved most valuable must go to a number of individuals besides the discoverer of the effect of caustic soda on cotton. The early operators worked with processes whose possibilities they had not grasped, attempting to get effects that have not proved of great practical interest, while the real value of the process was waiting patiently to be discovered. With trials and failures, patent suits and fortunes at stake the development of mercerizing has been one of the most romantic chapters in textile history.

John Mercer was born in 1791. He became a chemist and was associated with a Lancashire print works until 1848 when he devoted himself exclusively to research in industrial chemistry. It is said that we owe to him many processes and improvements in cloth printing. Even his mercerizing investigations and patents covered the use of various acids and other chemicals, schemes for treating fabrics containing wool and silk, and for obtaining crimp effects.

It is especially interesting to chemists to find this outstanding example of a chemist in the pursuit of science coming upon a very valuable commercial discovery, for Mercer in 1844 was trying to effect a separation of different hydrates of caustic soda by filtering a concentrated solution through cambric in the interest of a theory of solution. Caustic at 60 deg. Tw. came very slowly through six thicknesses of strong cloth and then tested only 53 degrees. Instead of noticing that the cloth was all crumpled up and throwing it into the slop jar, Mercer observed that it had really undergone an extraordinary change, having become semi-transparent, greatly contracted in length and width, and thickened or "fulled."

Since the effect on the cloth was incidental to his other work, as well as accidental, he apparently tucked this idea away until he had time to work on it. Unlike most of us, he found time, worked out explanations of the phenomenon, and took out a patent in 1850 in which he described the essentials of the process of mercerizing. He featured the "fulled" effect, the increase in strength

Courtesy Textile World

John Mercer

of yarn or cloth, and the enhanced affinity for dyes, but did not notice or apparently obtain any luster.

Mercer's Explanation

That Mercer was a thoughtful as well as a practical man is clearly indicated by his explanation of the phenomenon, which while hardly accepted now, has stood until very recently. He found that the alkali could be removed by washing in water, but that it stuck much more tenaciously than if merely held mechanically in solution among the fibers. This with the change in strength of caustic on filtering led to the conclusion that a definite compound was formed through the cotton retaining some of the alkali, but that it broke down on washing leaving a molecule of *water* attached to the cotton instead. A weighable increase in weight, and results of experiments on drying all fortified this theory.

For various reasons Mercer's process did not reach any extensive practical development. The high cost of caustic soda and the loss of area by shrinkage, 20 to 25 per cent in each direction, seem to have been the chief difficulties. Cloth mercerized without tension to obtain unshrinkable cotton has not been satisfactory as it has proved loose and stretchy. However, Mercer's patent must have appeared attractive as he was offered $200,000 for it before it had obtained any importance.

It is of interest that a French book mentions a Frenchman who anticipated Mercer, and a German book a German. In spite of these and other claimants to the honor, Mercer's is the name that has survived, and a monument has been erected to him at Great Harwood in England.

Beginning of Commercial Mercerization

Following Mercer there were chemical studies on the effect of caustic on cotton, experiments with single cotton fibers and other patents, but the next step of importance was by Horace Lowe, forty years later in 1889. He first noticed luster but did not describe in his first patent how to get it; his second patent described what is practically the process of to-day. It is sometimes said that commercial mercerization dates from 1890, although there was not yet much actual development. Again, like Mercer, this inventor practically missed the best part of his invention.

Two French dyers, Thomas and Prevost, located at Crefeld in Germany were working independently along the same lines as Lowe and patented the idea of preventing shrinkage, without mentioning luster, but the patent was annulled on the grounds of Mercer's earlier discovery. They noticed luster soon after, in 1895, and patented that feature, mercerization under tension. This was disallowed in several different countries on account of Lowe's priority, but the real commercial process dates from this time.

Thomas and Prevost were favored by working with better types of cotton than either of the others and naturally obtained a better luster which may account for their first noticing it. Since their process was operated and rights were sold in several countries their success really marked the beginning of commercial mercerizing, and this fact has led to much discussion on assigning the credit for this great advance in cotton finishing.

Thomas and Prevost seem to have appreciated the commercial value far better than Lowe, but he certainly recognized what could be done by his methods. The Society of Dyers and Colourists expressed its opinion in 1921 by awarding Lowe its highest honor, the Perkin Medal, "for the production of a permanent luster on cotton."

As soon as the new product appeared on the market it attracted attention and development in machinery and

Courtesy Textile World

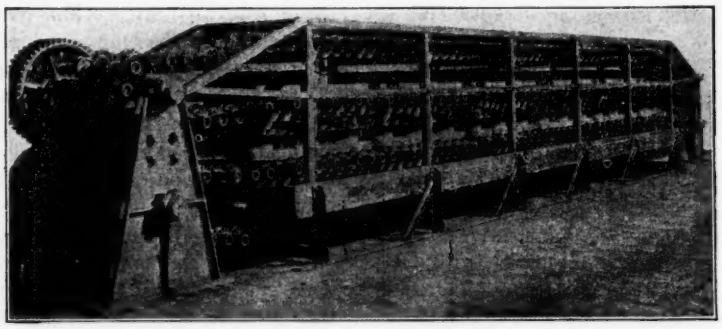
Monument Erected to Mercer

modifications of method were very rapid. The idea quickly traveled to America and now our scene will shift to this country.

Mercerization Appears in America

The merits of the process seem to have been appreciated here at once, for between 1895, the date of the most important patent, and 1898 a number of visitors went to England and Germany in quest of more information. A still more vigorous impulse was given the domestic developments when the foreign mercerizers began seeking an outlet here.

The first demands came from the silk trade for warps, the thread trade and from upholstery and drapery manufacturers. Skein work was taken up before warp partly because only small lots were wanted and partly because it was simpler at the start to pattern machinery after the foreign types of skein equipment. Work on piece goods lagged still further behind because of the expense of the necessary machinery and the lack of goods of suitable construction.



The "Oceanic" Mercerizing Machine *Courtesy Textile World*

Another deterring influence was the almost continual litigation that had been going on in England and Germany, and that threatened to nullify efforts here. Experiments were made by a great many individuals and firms, but a large share of the machinery and methods were kept secret. The uncertainty was naturally increased a little later as a result of the American Mercerizing Company's efforts to establish the Thomas and Prevost patents as basic, by suits and injunctions.

There is quite good evidence that J. R. Montgomery & Co., of Windsor Locks, Conn.; the Pennypack Yarn Finishing Company, of Philadelphia, which has since become the Forrest Mercerizing Company, of Gloucester City, N. J.; William H. Lorrimer's Sons Company, of Philadelphia, and the Aberfoyle Manufacturing Company, of Chester, Pa., were mercerizing skein yarn in a limited but satisfactory manner in the early summer of 1897, and that within a few more months the John Bancroft & Sons Company, of Wilmington, Del., began making deliveries of mercerized cloth.

Other prominent firms were also engaged in mercerizing during these early days, although at that time some of them had different firm names. Among them were Sayles Bleacheries, Acadia Mills, Gerald Cooper of Providence, Globe Dye Works of Philadelphia, Clark Thread Company, American Thread Company and no doubt others.

Legal Battles in the United States

When the Thomas and Prevost processes were patented in the United States, which was allowed through some oversight in the Patent Office, there was a repetition of the same sort of trouble that impeded progress in Europe for several years. The American Mercerizing Company was incorporated in the summer of 1899 to take over the American rights. This company consisted principally of representatives of several of the leading mercerizers of the day, who were operating under the firm's licenses. Since any other mercerizer was an apparent infringer, a test case was made against the Hampton Company, of Easthampton, Mass., and specifically against a certain United States patent which they were using.

This became one of the most noted cases of the textile industry as well as an important event in mercerizing history. It lasted through six years and if the patents had stood, the American Mercerizing Company would have paid the German owners $750,000. What their own income in license fees would have been can only be conjectured, but since it was claimed that $17,000,000 worth of yarn was mercerized in five years by unlicensed firms, the interests involved were sufficient to enlist a great array of legal and expert talent. Among the chemists and manufacturers who appeared for the complainants were Arthur D. Little, John H. Lorimer and William H. Walker; for the defense, Frank Cheney, Jr., William D. Hartshorne, Charles F. Chandler, Otis L. Humphrey and the late William W. Crosby. The preparation of the cases for both sides involved an enormous amount of research work and practical demonstrations. The records of the case cover about 2,000 pages and are a very accurate account of the state of the art at that time.

As usual, in such cases some very strange points were brought out; there was demonstrated proof that luster was an *unavoidable result* of both the Mercer and Lowe processes provided suitable yarns were used in ordinary warp dyeing and cistern-roller machines. Quoting from one of the briefs, "The use of roller-cistern apparatus as directed in Mercer's original patent . . . would sufficiently counteract the tendency to shrinkage caused by the caustic alkali in the process of mercerizing cotton yarn in warp chain, and presumably also cotton cloth in the piece, to enable the yarn or cloth so treated to exhibit when dry practically all the silky luster of which it is capable when subjected to any other known process of mercerization under tension. Indeed, practical proof of

this fact has been furnished on a commercial scale by the circumstance that the Arlington Mills, of Lawrence, Mass., began its mercerization of cotton warps to be woven into fancy dress goods manufactured for the markets in the fall of 1897 by the use of just such a roller-cistern apparatus, which had previously been used for warp dyeing and which had no squeezing rolls at its initial end. The product was entirely satisfactory and demonstrated the efficiency of the old roller-cistern apparatus for restraining shrinkage sufficiently to secure a degree of silky luster, which satisfied the requirements of the market."

The result of the case was that the process of mercerizing was made free to anybody.

American Patents and Machinery

It was quite the custom for the mercerizer to build his own machinery, and while now there are several well-known manufacturers of machines for the market, there are still mercerizers who use those of their own construction, for instance, the Gerald Cooper Company and the Lorimers.

United States patents were issued to foreign inventors of mercerizing equipment as early as 1897, and the first two issued to Americans appear to be those in 1898 to James R. Hope, of Philadelphia, and to H. W. Butterworth, of Philadelphia, a name now associated with one of the largest makers of mercerizing machinery. While some mercerizers were building machines, regular machinery builders were also contributing very largely to the early success of mercerizing, and the first to bring out successful machines were H. W. Butterworth & Sons Company and Lorimer Machine Company, both of Philadelphia, and the Textile Finishing Machinery Company, of Providence, through its predecessors, the Granger Foundry & Machine Company and the Rusden Machine Company.

The following notes attributed to H. P. Reno, of the Sayles Finishing Plants, Inc., are particularly interesting and give an idea of the somewhat crude methods in use: "For the first few years the process of mercerizing as carried out here was as follows: The padding machine was driven by a steam engine and cloth was run through the pad and batched upon the top roll, then lowered to the front of the machine and run through a second time. Caustic soda was used at about 48 deg. Tw. and an ice-chest was used to keep it cool. Fresh caustic was carried in a storage tank and then pumped through a series of coils in the ice-chest to two mixing tanks from which it ran by gravity to the caustic pad. In the summer of 1899 one tip-cart was kept busy all day hauling ice from the ice-house to this ice-chest. After the cloth had been padded the rolls were taken to the mercerizing frames and washed while under tension."

As the market for mercerized yarns became established it was soon evident that more rapid production was necessary, and the natural step from the batch skein to continuous skein and warp mercerizing machines was soon taken. The continuous skein machines have not reached any great development. One of the most striking was the "Oceanic," so called from its great size, 140 feet long and high in proportion. The principle was the carrying of stretched skeins by an endless chain system, through the caustic and washing tanks. In spite of its size it lacked both strength and capacity.

Other pioneers were working in what has since proved to be the more practical direction, warp mercerizing. The first Butterworth machine was designed in 1897. While different skein machines have developed along somewhat different lines, the warp machines are merely modifications and enlargements of the older patterns, for the principle in them all is the same.

The success of warp machines can be appreciated from a plant like the Aberfoyle at Chester, Pa., which is now the largest in this country and probably in the world engaged in yarn mercerizing, with four modern warp machines carrying a day shift, weekly production of nearly 450,000 pounds of yarn. However, the result of the immense strides within a space of twenty-five years, leading up to modern methods and equipment, will be better and more completely shown by other writers in later articles of this series.

(To be continued)

SALESMEN'S ASSOCIATION OF AMERICAN CHEMICAL INDUSTRY

The election of officers of the Salesmen's Association of the American Chemical Industry will be held at the annual meeting this month. The nominees for president are Dr. F. P. Summers, of the Noil Chemical & Color Company, New York, and George Dunning, of the Michigan Alkali Company, New York. Nominees for vice-presidents include the following: E. J. Barber, of White Tar Company; Adolph Schwarz, of Roessler & Hasslacher Chemical Company; George Stettner, of Algone Chemical Company; J. G. Harrison, of Barium Reduction Corporation; Joseph Hollywood, Coal-Tar Dyes, Inc., and H. F. Wilmot, of the Synthetic Organic Chemical Manufacturers' Association. For secretary, W. H. Adkins, of Monsanto Chemical Works, and C. F. McKenna, of Federal Phosphorus Company, were named. The nominees for treasurer are Hepburn Chamberlain, of Hooker Electrochemical Company, and Robert Quinn, of Mathieson Alkali Works. The executive committee candidates, of whom two are to be elected, include John Chew, of Warner Chemical Company; A. H. Pierce, of Grasselli Dyestuff Corporation; George Bode, of Roessler & Hasslacher Chemical Company; H. B. Prior, New York representative for J. T. Baker Chemical Company. Two candidates for each office are required to be nominated by the by-laws of the association.

The Deterioration of Wool Due to Atmospheric Causes

Factors Which Cause Deterioration—Influence of Other Materials on the Weather Effect—The Action of the Ultra-Violet Rays—Examination of Dyed Samples of Wool—General Results Obtained—Discussion of Results—Effect of After-Chrome—The Depth of the Action on the Wool—The Double Role of the Dyestuff

By DR. P. HEERMANN

(*Chemiker Zeitung*, 1924, 337-8)

Translated by Ismar Ginsberg, B.Sc., Chem. Eng.

ABOUT five years ago Kertesz published the results of a very interesting investigation on the withering of wool. (For details see Zeitschrift fuer angewandte Chemie, 1919, page 168.) Woolen cloth had undergone certain changes during usage, which consisted in the surface of the cloth appearing to be scraped off, so that the underlying fibers that comprise the structure of the fiber penetrated through the surface and the cloth took on the appearance of a worn cotton fabric more than anything else. According to Kartesz, the reasons for this wearing away of the woolen fabric might be traced by *a priori* reasoning to the four following causes:

1. Unsuitable material or bad dyes.
2. Too strong rubbing or wearing action on the cloth.
3. The effect of various gases or vapors.
4. Errors made in the clearing and disinfection of the wool.

The exhaustive tests which were made by Kertesz had, however, shown that all these causes were excluded in this particular case, and that the same worn surface of the woolen cloth was obtained when the fabric was allowed to be acted upon by the sun's rays, or the wind and weather for a prolonged period of time. In this connection it was found that all kinds of wool and woolen fabrics were subjected to this action and that the pure white variety of wool was most sensitive to this influence while the dyed goods were more resistant.

Influence of Other Materials on the Weather Effect

It was also found that this phenomenon was not affected by the use of fats and soaps. Alkalies promote the action, while acids prevent the gradual decomposition of the wool up to a certain extent. Various individual metallic salts, such as the salts of chromium, appeared to have a protective action on the woolen fiber.

The tests which were made on a small scale showed that from eight to twelve months' exposure is necessary to complete the destruction of the wool. This means that any white woolen cloth, also goods of the highest possible quality, which are allowed to hang in the open on a clothes-line, show a distinctly abraded or scraped surface. The start of the decomposition of the woolen fiber can be detected by means of the biuret reaction after a period of a few weeks. The same effect was produced in a marked manner when the cloth was subjected to the action of the ultra-violet rays from a mercury arc lamp, while ozone alone does not appear to have such an action. The conclusion that was reached from these observations was that the sun's rays are most potent in bringing about this phenomenon, while the presence both of moisture and heat has the effect of accelerating the reaction. This reaction may then be considered as being of a photochemical character.

The Action of the Ultra-Violet Rays

One matter that seemed to remain in an undecided condition at the end of the investigation which was carried out by Kertesz was the influence of the ultra-violet rays on the woolen fiber. In fact, too little is known about the action of these rays on the various fibers that are commonly employed in the textile industry. There is no doubt tbut that the matter is one of the highest practical importance to the textile man, and the purpose of the author in carrying out the series of investigations, of which this is a report, was to determine the exact conditions under which this phenomenon, first observed by Kertesz, takes place. This is particularly important because there are certain investigators who do not agree that the destructive action on the woolen fabric is brought about by rays of light. Before proceeding further in this discussion, the author wishes to state that he found the ultra-violet rays to have a decidedly harmful effect on the woolen fabric. Furthermore, the author observed a number of very peculiar and interesting efforts, all of which are of considerable value from the practical standpoint, and which have never before been observed.

Examination of Dyed Samples of Wool

Samples of wool were dyed with eight different dyestuffs which are used as standards of fastness by the German committee on the fastness of dyestuffs. These dyes are given below. The pure woolen fabric was dyed

and then subjected to the action of ultra-violet rays. Three series of experiments were carried out in the following manner:

1. The samples were subjected to the ultra-violet rays emanating from a mercury arc lamp, 1,500 candle-power, the source of light being arranged at a distance of 16 centimeters from the samples of cloth.

2. The samples were subjected to the rays of ordinary sunlight, no glass covering being placed over them, the rays of the sun being refracted through a glass roof, arranged over the sample, so that they were protected from the action of the weather, but given as strong a sunlight treatment as was possible.

3. The samples were subjected to the action of sunlight, but were covered with glass plates, so that only the rays of light of long wave length were able to penetrate through the covering and come in contact with the samples.

General Results Obtained

The results obtained in this experiment are given below. From them it may be concluded that direct daylight, that is, sunlight and diffused daylight, as well as the rays of the ultra-violet light, have a more or less definite effect on the woolen fiber, bringing about its partial decomposition, and this effect depends, of course, on the duration of the treatment, and also on the nature of the dyestuff employed. The duration of the treatment in the case of daylight was about half a year, from March to September, while in the case of the ultra-violet light is was only sixty-four hours. Mechanical influences, such as friction and ordinary wear and tear, play no part in this research, as in all cases the samples were stretched tightly so that no friction effect could take place. The time of treatment in daylight was converted into hours of effective sunlight according to meteorological tables, so that standard conditions were observed, and a better understanding of the phenomenon through a more accurate definition of the time of treatment was possible.

Test with Three Per Cent Indigotin

A sample of wool was dyed with a 3 per cent solution of indigotin, which represents the first class of fastness according to standard. When the cloth was subjected to ultra-violet rays for sixteen hours, first signs of deterioration were visible. Subjected to sunlight, without glass covering, slight deterioration was observed after six weeks, equivalent to 206.1 hours of sunlight. Subjected to sunlight through glass, indirect sunlight, no deterioration could be observed after six weeks, equivalent to 206.1 hours of sunlight.

Test with 1.5 Per Cent of Ponceau RR

Wool cloth dyed with 1.5 per cent of Ponceau RR. Second class of fastness.

Ultra-violet ray test: Clear deterioration after sixty-four hours.

Direct sunlight test: Slight deterioration after 206.1 sunlight hours.

Indirect sunlight test: No deterioration after 206.1 sunlight hours.

Test with 2.75 Per Cent Naphthol Red S

Wool cloth dyed with 2.75 per cent Naphthol Red S. Third class of fastness.

Ultra-violet ray test: Clear deterioration after thirty-two hours.

Direct sunlight test: Clear deterioration after twelve weeks or 598 sunlight hours.

Indirect sunlight test: No deterioration after twelve weeks or 598 sunlight hours.

Test with 4.5 Per Cent Azo Acid Red B

Wool cloth dyed with 4.5 per cent of Azo Acid Red B. Fourth class of fastness.

Ultra-violet ray test: Clear deterioration after sixty-four hours.

Direct sunlight test: Clear deterioration after thirteen weeks or 652.3 sunlight hours.

Indirect sunlight test: No deterioration or only slight traces after thirteen weeks or 652.3 sunlight hours.

Test with 5 Per Cent Acid Violet 4 RN

Wool cloth dyed with 5 per cent Acid Violet 4RN. Fifth class of fastness.

Ultra-violet ray test: Clear deterioration but not so pronounced as in the former tests.

Direct sunlight: Deterioration after thirteen weeks, equivalent to 652.3 sunlight hours.

Indirect sunlight: Deterioration scarcely visible after thirteen weeks, equivalent to 652.3 sunlight hours.

Test with 2.5 Per Cent of Diamine Fast Red and 1 Per Cent of Potassium Chromate

Wool cloth dyed with 2.5 per cent of Diamine Fast Red and after-chromed with 1 per cent of potassium chromate. Sixth class of fastness.

Ultra-violet ray test: Not so clearly deteriorated as in the other tests, which were carried out for some length of time, namely, sixty-four hours.

Direct sunlight: Not so clearly deteriorated as in other tests of longer duration after exposure of nineteen weeks or 904.8 sunlight hours.

Indirect sunlight: No deterioration after nineteen weeks or 904.8 sunlight hours.

Test with 4 Per Cent Anthraquinone Green GXN

Wool cloth dyed with 4 per cent of Anthraquinone Green GXN. Seventh class of fastness.

Ultra-violet ray test: Very strongly deteriorated after sixty-four hours.

Direct sunlight test: Very strongly deteriorated after nineteen weeks or 904.8 sunlight hours.

Indirect sunlight test: Scarcely deteriorated after nineteen weeks.

Test with Indigo and Sulphocyanin GR Extra

Wool dyed with 2.4 per cent of Sulphocyanin GR Extra and Indigo. Eighth degree of fastness.

Ultra-violet ray test: Strong deterioration after sixty four hours.

Direct sunlight test: Strong deterioration after twenty-six weeks or 1,164.4 sunlight hours.

Indirect sunlight test: Hardly any deterioration after twenty-six weeks or 1,164.4 and no change after washing.

Discussion of Results

The woolen cloth in the last test, subjected to direct sunlight, became dirty after half a year's exposure and was accordingly washed with a solution of a textile soap. After this treatment, the deterioration in the wool was very evident. The common rough surface of the woolen cloth was completely removed, and the underlying fabric was revealed in the clearest manner. The corresponding sample of wool cloth dyed with Anthraquinone Green was subjected to the same treatment, but there was no sign of deterioration.

The conclusion that can be drawn from these observations is that in addition to the manner in which the wool is exposed to light and the nature of the light itself, the character of the dyestuff used in dyeing the cloth and the chemical treatment that the wool receives in the dyeing plant endow the woolen fiber with the property of resisting the action of weather or light to a greater or lesser degree, as well as the effect of washing after exposure to light. In the last experiment made the treatment of the woolen fabric in the alkaline dye bath rendered it particularly sensitive to the action of light. The fact that the effect of light was only manifested in its highest intensity after the cloth had been washed with water is not as remarkable as it appears, for common experience explains this condition.

Reference is had to the observation that when woolen fabric is dyed in a dye liquor acidified with sulphuric acid, the effect of the treatment on the fiber is not apparent at once, but the wool is so changed that when it is treated afterward in an alkaline bath, it cannot hold upon against the action of the alkali.

Effect of After-Chroming

The after-chrome treatment of the wool, as carried out in the test made with the Diamine Fast Red dyed fabric, appears to have some effect on the ease with which the fiber resists the deteriorating action of sunlight, for in this case the degree of deterioration is not so marked as in the case where the fiber is not given an after-chrome treatment. It has formerly been observed that the tensile strength of after-chrome dyed woolen fabrics is not so strongly affected by exposure to sunlight as when the fabric is dyed with dyestuffs in which the chrome mordant is not employed.

As far as can be seen from the experiments described above, the deterioration of the woolen cloth, which may be designated as the Kertesz phenomenon, is an action that depends on the destructive effect of rays on light on the fine wool fibrils which give the surface of woolen cloth its characteristic feel and appearance. The reaction must be considered as a purely photochemical process. But in contradistinction to such reactions, in which the long wave length rays of light act in conjunction with the others or are most potent of all the rays in light, this particular reaction is brought about by the short rays of light.

For example, if it is assumed that rays of light with a wave length greater than 3,500 mu can pass through glass and rays under 1,800 mu, while not able to pass through glass, are present either in sunlight or in the light emanated from the mercury arc lamp, then the conclusion is readily drawn that the deterioration effect of light on wool is brought about by rays that possess dimensions between 2,000 and 3,500 mu, or, at least that these rays are most potent in causing the withering of the woolen cloth. The experiments clearly indicated that the samples of wool, that were indirectly exposed to sunlight under glass through which only those rays of light possessing wave lengths in excess of 3,500 mu could penetrate, were but little changed by the treatment, even when the experiment lasted as long as six months. As far as the effect of rays of light possessing wave lengths under 1,800 mu is concerned, it is understandable that their action is particularly strong on the woolen cloth. However, they are not of any practical importance, for such short wave lengths occur only in light produced under artificial conditions in a vacuum.

The Depth of the Action on Wool

During the course of the experiments it was observed that the action of light on the woolen cloth was limited to the surface fibril only. If there was any action on the fibers within the cloth structure itself, it was of only slight degree. The general conclusion may therefore be drawn that only the finest fibers directly on the surface of the woolen cloth and the loose fibers lying directly underneath these, to which the light easily penetrates, were affected by the light. On the other hand, the main portion of the fabric was not attacked. The quantitative character of this process was not investigated but is left for further study. It has its peculiar importance besides being of certain purely scientific interest.

The study which has been the subject of this investigation has served to define in a clear manner the nature of the phenomenon which brings about the deterioration or withering of woolen cloth when exposed to the action of light. The question still remains, does the chemical treatment and the dyestuff employed in coloring the fiber have any additional action on the woolen cloth along the

same lines? The question is, however, one of secondary importance only and its solution is fraught with all kinds of difficulties.

It may be concluded that the role played by the dyestuff employed in coloring the fabric is of twofold character. In the first place, the fastness of the dyestuff is of importance, as dyes which are not fast are oxidized by the action of sunlight. It appears that this action of the light rays on the dyestuff tends to protect the fabric itself from the destructive action of light. It has been found that the property of polyphenols of combining with oxygen has the effect of increasing the stability of colors on the textile fiber to light. On the other hand, it has also been found that the property of sulpho-ureas for combining with oxygen or of other decomposition products of albumen for acting in the same manner had the effect of increasing to a considerable degree the stability of weighted silken fabrics to light.

Then again, the optical condition of the dye on the fabric has some influence on the action of light on the woolen fiber. This is a matter which requires considerable explanation before it can be correctly understood.

Things Every Textile Chemist and Colorist Should Know

[*Note—Under this heading there is being published, as a more or less regular feature, the discussion of certain fundamentals which should be a part of every textile chemist's and colorist's working knowledge. It is hoped that such discussions will instruct and interest some of the younger readers, and serve as a review for those of broader experience and knowledge.*]

No. 12—To Tell the Common Fibers Apart

IN spite the more or less elaborate methods of distinguishing between the various common textile fibers, one working in the ordinary laboratory needs very few appliances for their identification unless, possibly, confronted by some rather special problem. A great many of the tests recommended are to be made on the whole piece of yarn or cloth as received, but better information is often obtained by removing single fibers of the greatest possible length, for test and observation. Mixed fibers should be separated if possible and examined separately.

The microscope is the quickest and most useful aid and it does not take a very high power to detect wool or cotton fibers at a glance if merely put dry under a cover glass to hold them flat. Wool is usually large in diameter, and is distinguished by its roundness and characteristic scales. Cotton has the flat twisted appearance that cannot be mistaken for any other fiber. Photomicrographs and descriptions are too common to need repeating here. A glance at a known fiber for comparison is usually sufficient confirmation.

The next convenient reagent is a match. The vegetable fibers burn up clean, usually with but a trace of ash. Wool and silk burn in a characteristic way, leaving a black globule on the end of the fiber if the flame is extinguished. They have a characteristic odor, which with the appearance on burning can be checked with a known sample. (Single fibers are hardly large enough for burning tests.) Heavily weighted silk may act a little differently, but is not likely to be mistaken for anything else. It usually burns with some difficulty, and leaves a large ash that retains the original shape of the sample. If a further test is necessary the microscope will distinguish it from wool or cotton. It will not be confused with artificial silk because the latter is not weighted.

Wool and silk are very elastic as compared with vegetable fibers, and this property is easily felt by stretching and releasing a single fiber.

Except in spun silk, the silk filament is much longer than the wool fibers. Silk is soluble in concentrated hydrochloric acid while wool is not. In any case the microscope will decide, but it is hardly necessary after a little practice, especially if these simple observations are made along with similar tests on fibers of known origin.

Artificial silk has the appearance of real silk, but burns more like cotton. Acetate silk has some odor and leaves more residue than the other cellulose silks. Artificial silks from gelatin are scarcely articles of commerce and are not considered here.

The distinction of cotton from linen is important to the consumer, and is sometimes a problem in a mill laboratory. There are a multitude of methods, many of which appear to be little better than guessing. The simplest, quickest and most reliable is the microscope, for it tells at once that the article is, or is not cotton, or shows whether it is a mixture. If it looks like cotton, but is not, it is not likely to be anything but linen. There is one interesting method that does not seem to be widely used but is very practical and requires no apparatus or reagents. It employs the fiber bundle property of flax that was described under "The Classes of Vegetable Fibers." Untwist a thread of the goods and pull out a few of the resulting loose fibers. If they average an inch long (rarely much more than an inch) and each is a separate unbranching unit, they are cotton. On the other hand, if by careful handling one can find a fiber here and there which is longer and

thicker and shows branches that will split off as separate fibers, the material contains a bast fiber, which is probably linen.

During the past few years hemp has been used in place of flax (which term we are using synonymously with linen, into which it is manufactured) not only in shoe and harness threads but in some bleached fabrics. Some hemp has been used in this way in Europe for many years. This may introduce a complication in examining linen goods, but according to recent publications, there is a simple way out of the difficulty. Flax and hemp have always been very hard to distinguish, especially if mixed together, either by chemical tests or the microscope, and some investigators have considered it impossible. At any rate, a great deal of experience will be required before results can be considered at all reliable by the older methods.

The new method is to separate the individual fibers and wet them for a few minutes in warm water, then hold them one at a time with the free end toward the observer. Each fiber as it dries will twist, flax in a clockwise direction and hemp the opposite way. This is claimed to be true for fibers in any stage of manufacture from raw fiber to bleached product.

Incidentally ramie twists in the same way as flax and jute the same as hemp.

There may be a slight momentary twist in the opposite direction, but the final twist will continue long enough so that there will be no cause for mistake.

Jute, as a rule, does not enter into highly finished fabrics and can usually be told in the rough state without tests. However, there are times when it is not easily distinguished from rough flax or hemp. Jute, however, differs fundamentally from them in being a lignocellulose so it responds very quickly to the lignocellulose tests. For ordinary purposes apply them to the fiber at once, without any severe boiling out for the more the fibers are purified the less readily do they respond.

Several tests give very distinct colors with common chemical reagents. A strong solution of aniline hydrochloride will give an immediate yellow color. For another test immerse the fibers in a strong acidified solution of bleaching powder (5 per cent bleach), rinse and treat with neutral sodium sulphite (3 per cent solution). Jute immediately turns deep red. A third test which gives just as striking results is made by treating with a solution of 4 grams of phloroglucinol in 100 c.c. of water and 100 c.c. of strong hydrochloric acid. Jute turns red.

Flax and hemp do not respond to these tests to any marked extent. The reactions will not be as pronounced with jute that is not in the raw state.

Following out these ideas, most of the common fibers can be quickly identified for ordinary purposes without the use of uncommon reagents, elaborate tests or complicated systems of analysis.

Abstracts of Papers

DELIVERED BEFORE THE DYE DIVISION OF THE AMERICAN CHEMICAL SOCIETY

FALL MEETING, ITHACA, N. Y., SEPTEMBER, 1924

A Preliminary Paper on the Chemical Role of Inorganic Salts as "Leveling Agents" in Dyeing

C. E. White and Neil E. Gordon

There seems to be a disagreement in the literature as to the role played by salts used in the dye baths as leveling agents. Their action has been attributed mainly to colloidal action influenced by the negative charges on ions of the salt.

Since it has been observed that these salts have the same restraining action on the adsorption of dyes by gels as with wool; an effort has been made to study this phenomenon by the use of gels with various acid dyes. Experiments carried out thus far, with iron gel, and Orange II dye using KH_2PO_4 and H_3PO_4 as restraining agents, seem to indicate that the iron forms a compound with the phosphate preventing the formation of the Iron-Orange II compound.

The Analysis of Synthetic Indigo by Means of Titanous Chloride

F. L. English and W. S. Calcott

Preliminary report is made of a direct method for the titration of Indigo with N/4 $CiCl_3$ without previous sulphonation of the sample. Through lack of time, this method has not been perfected to the desired degree of accuracy, the progress of the work done to date being recorded in the hope that it may be of value to other investigators in the same field.

The development of a method depending upon sulphonation of the sample and titration with N/20 $TiCl_3$ is described in detail, typical results upon crude and purified synthetic indigo being given which prove the method capable of yielding results accurate within 0.2 per cent.

Toluidine Derivatives: I. Quantitative Preparation of 5-Iodo-2-Amino-Toluene and Some of Its Derivatives

By Raymond M. Hann and Julius F. T. Berliner

Conditions resulting in a quantitative (approx. 99 per cent of theory) yield of 5-iodo-2-amino-toluene by the action of iodine on o-toluidine hydrochloride are described. The process is complete in one and one-quarter hours and does away with the troublesome steam distillation formerly employed.

The following derivatives were prepared and analyzed. The hydrochloride, hydrobromide, hydroiodide, hydrofluoride, perchlorate, picrate picroloxate, iodate, oxalate, mercuric chloride (2:1), urea, phenyl urea, urea hydrochloride, alpha-naphthyl urea, and the carbylamine derivatives.

(*Continued on page* 627)

Foreign Dyes Imported Through the Port of New York During August

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862.
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilinfabrik Boyer & Kegel, Furstenberg, near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldorf. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887.

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

THE imports of coal-tar dyes for August, 1924, through the port of New York totaled 64,546 pounds, with an invoice value of $71,290. In addition, imports through other ports include 14,750 pounds, with an invoice value of $14,521, for Providence; 1,000 pounds, with an invoice value of $1,142, for Boston, and 100 pounds, with a value of $61, for Philadelphia.

The conspicuous drop in the August dye imports may be largely accounted for by the two following factors:

1. The subnormal activity of the domestic textile industry.

2. Anticipation of the reduction in the ad valorem rate of duty on dyes from 60 per cent to 45 per cent on September 22, 1924. In connection with (2) the stocks of dyes in bonded warehouse are of interest. The following figures taken from "Monthly Summary of Foreign Commerce of the United States, Department of Commerce" indicate warehouse stocks as of July 1, 1924. The "general imports" (embracing imported articles entered for immediate consumption on arrival and articles entered for warehouse) of coal-tar dyes (for the first six months of 1924) amounted to 1,748,308 pounds, while the "imports for consumption" (embracing imports entered for immediate consumption and withdrawals from warehouse for consumption) amounted to 1,583,677 pounds. The excess of the general imports over the imports for consumption is accordingly 164,631 pounds. Deducting 36,449 pounds, representing the re-exports of foreign coal-tar dyes for the first six months of 1924, leaves a total of 128,182 pounds in the warehouse as of July 1, 1924, which may be withdrawn for consumption or for exportation. It may be expected that these dye stocks have been materially increased during the month of July.

According to the "Monthly Summary of Foreign Commerce for June, 1924," the total stocks of coal-tar intermediates remaining in bonded custom warehouses on June 30, 1924, amounted to 1,196,757 pounds.

Imports of Dyes Through the Port of New York, 1924

Month	Pounds	Value
January	288,743	$232,571
February	158,874	176,657
March	293,862	302,016
April	174,880	182,253
May	167,245	165,521
June	147,380	151,331
July	140,810	137,075
August	64,546	71,290

Five Leading Dyes by Quantity Imported

	Pounds
Hydron Brown	8,390
Indanthrene Golden Orange R	7,065
Indanthrene Red BN	4,662
Alizarine Blue Black B	3,425
Xylene Light Yellow	3,307

Per Cent of Quantity by Country of Shipment

Germany	59	England	3
Switzerland	27	Holland	2
Italy	5	Canada	1
France	3		

Following are the imports of medicinals, intermediates, photographic developers and other coal-tar chemicals. The poundages given are approximate, because a small quantity of the medicinals were reported in ampoules, the exact weight of which is not known:

Month	Pounds	Value
January	201,271	$48,116
February	55,094	16,870
March	212,343	46,254
April	21,550	22,789
May	17,534	7,001
June	106,127	22,669
July	5,718	10,245
August	4,332	8,062

Imports of Color Lakes

Month	Pounds	Value
January	None	None
February	4,181	$1,848
March	11,520	3,343
April	2,956	2,143
May	3,421	1,034
June	330	463
July	390	320
August	250	....

The dyes in this report are grouped by Schultz numbers, and in the case of those which could not be identified by Schultz number the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

The designation of "†" for competitive and "*" for non-competitive indicates the appraisement basis for the assessment of the ad valorem duty in paragraph 28 of the Tariff Act of 1922. Those dyes without designation are doubtful, pending further investigation.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

DYES OF COAL-TAR ORIGIN

This table includes imports through the port of New York to the amount of 64,546 pounds, and also 14,750 pounds from Providence, 1,000 pounds from Boston and 100 pounds from Philadelphia.

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
22	Xylene Light Yellow	3,307
	Xylene Light Yellow 2G Conc.—(S)	
177	Mordant Yellow	500
	Milling Yellow O—(C)	
217	Agalina Black 10B	50
	Agalina Black 10BX—(B)	
220	Palatine Black	50
	Wool Black 6B—(A)	
265	Sulphon Cyanine Black	455
	Acid Milling Black B—(G)	
273	Diaminogene Blue	841
	*Diaminogene Blue NA—(C)	
319	Diamine Scarlet	15
	Universal Bordeaux C—(C)	
327	Diamine Violet N	15
	Universal Violet C—(C)	
339	Brilliant Orange G	200
	Diamine Orange B—(C)	
344	Diamine Brown	15
	Universal Dark Brown C—(C)	
348	Diphenyl Brown BN	551
	Diphenyl Brown GS—(G)	
349	Diamine Brown B	15
	Universal Olive Brown C—(C)	
363	Benzopurpurine 4B	15
	Universal Scarlet C—(C)	
415	Dianil Blue G	15
	Universal Light Blue C—(C)	
423	Chicago Blue B	15
	Universal Steel Blue C—(C)	
456	Benzo Fast Blue	220
	Benzo Fast Blue 4GL—(By)	
459	Benzo Black Blue G	15
	Universal Dark Blue C—(C)	
474	Oxamine Green B	15
	Universal Dark Green C—(C)	
476	Benzamine Brown 3GO	110
	Cupranil Brown G—(I)	
516	Crystal Violet—(CN)	50
541	Brilliant Dianil Blue 6G	220
	*Direct Brilliant Blue 8B—(I)	
543	Patent Blue	1,791
	†Brilliant Acid Blue V—(By)	
	Patent Blue V—(M)	

Schultz No.	Name of Dye and Manufacturer	Quantity (pounds)
545	Patent Blue A	881
	†Brilliant Acid Blue A 50%—(By)	
552	Chromal Blue	331
	*Chromal Blue GC for printing—(G)	
571	Rhodamine 6G	495
	*Rhodamine 6G Extra—(I)	
	*Rhodamine 6GDN Extra—(B)	
573	Rhodamine B	250
	Rhodamine B Extra—(Q)	
587	Eosine	58
	Eosine A—(CN)	
622	*Delphine Blue B—(Q)	220
644	Ultracyanine B, R	500
	*Ultracyanine RB—(S)	
659	Methylene Blue	45
	Methylene Blue NB—(CN)	
	Methylene Blue, zinc free—(CN)	
667	Indochromine	271
	*Brilliant Alizarine Blue R—(By)	
672	Azo Carmine	340
	Azo Carmine GX—(B)	
733	Immedial Indone	880
	Immedial Indogene GCL Conc.—(C)	
759	Anthraflavone G (sgle. stngth.)	1,678
	*Anthra Yellow GC Paste—(B)	
	*Anthra Yellow GC Powder—(B)	
	Anthraflavone GC Powder—(B)	
761	Indan. Gldn. Orange R (sgle. stngth.)	7,065
	*Indan. Gldn. Orange RRT Pst.—(B)	
	*Vat Orange RRT Paste—(B)	
	*Vat Orange RRT Paste Fine—(B)	
	Helindone Golden Orange IRRT Paste —(M)	
767	Indan. Violet RR (sgle. stngth.)	474
	Vat Brill. Violet RR Pst., Fine—(B)	
778	Alizarine, Synthetic	221
	†Alizarine Red IB Ex. 20% Pst.—(By)	
780	Alizazrine Red	551
	Alizarine Red W Powder—(By)	
794	Cibanone Black	880
	Cibanone Black 2G Powder—(I)	
797	Alizarine Garnet	250
	Alizarine Claret R 15% Pst.—(M)	
804	Alizarine Blue S	827
	Alizarine Blue S Powder—(B)	
	*Alizarine Blue S Powder—(By)	
831	Indan. Red BN (sgle. stngth.)	4,662
	*Duranthrene Red BN Paste—(BD)	
	Helindone Red DIBN Ex. Paste—(M)	
	*Indan. Red BN Ex. Paste—(B)	
	Indan. Red BN Ex. Powder—(B)	
	*Vat Red RK Paste—(B)	
	Vat Red RK Paste Fine—(B)	
	*Vat Red RK Powder—(B)	
832	Indan. Violet RN (sgle. stngth.)	1,123
	*Vat Violet BN Paste—(B)	
842	Indan. Blue GCD (sgle. stngth.)	2,524
	Vat Blue GCD Dbl. Pst. Fine—(B)	
849	Indan. Yellow (sgle. stngth.)	1,080
	Helindone Yellow IG Dbl. Pst.—(M)	
	Indan. Yellow G Dbl. Pst.—(B)	
851	Alizarine Direct Blue B—(M)	100
852	Alizarine Irisol D, R	574
	*Alizarine Blue JR Powder—(By)	
	Alizarine Irisol R Powder—(By)	
855	Alizarine Pure Blue B	220
	Alizarine Sky Blue B Powder—(By)	
856	Alizarine Astrol	1,959
	*Alizarine Astrol B Powder—(By)	
	*Alizarine Blue AS Powder—(By)	
858	Alizarine Saphirol B	2,040
	Alizarine Light Blue SE Conc.—(S)	
	Alizarine Saphirol SE—(By)	
	Alizarine Blue SAWSA Powder—(By)	
860	Cyananthrol G	224
	Alizarine Direct Blue BGAOO—(B)	
862	Alizarine Blue Black B	3,425
	†Alizarine Blue Black B Powder—(By)	
	†Alizarine Blue Black B 80%—(By)	
865	Alizarine Direct Green G	55
	†Alizarine Cyanine Green G Ex. Powder —(By)	
869	Algol Brown R (sgle. stngth.)	525
	*Vat Brown R Paste—(By)	
	Vat Brown R Powder—(By)	
871	Indan. Violet RN	923
	*Vat Red Violet RRK Paste Fine—(B)	
876	Indigo, White	100
	Indigosol O Powder 100%—(B)	
885	Brilliant Indigo B	837
	Brilliant Indigo B Paste 20%—(B)	
897	Ciba Heliotrope B (sgle. stngth.)	2,270
	Ciba Heliotrope B Paste—(I)	
	*Ciba Heliotrope B Powder—(I)	
907	Ciba Scarlet	1,661
	Ciba Scarlet G Ex. Paste—(I)—(661)	
	Vat Fast Scarlet C Pst.—(M)—(1,000)	
908	Ciba Red R Paste	2,205
	*Ciba Red R Paste—(I)	
912	Ciba Pink BG (sgle. stngth.)	550
	Ciba Pink BG Powder—(I)	
913	Helindone Orange R (sgle. stngth.)	3,000
	Hydron Orange RF Paste—(C)	
	Hydron Orange RF Powder—(C)	
918	Helindone Red 3B	500
	Vat Red 3B Paste—(M)	
919	Ciba Bordeaux B (sgle. stngth.)	2,328
	*Ciba Bordeaux B Powder—(I)	
923	Ursol	100
	Fur Gray ALA—(A)	

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Alizarine Leveling Green B—(C)	25
Alizarine Rubinol	1,610
*Alizarine Rubinol GW—(By)	
*Alizarine Rubinol 3G—(By)	
*Alizarine Rubine R Powder—(By)	
*Alizarine Rubinol R Powder—(By)	
Azo Wool Violet 7R—(C)	25
Cloth Fast Yellow G—(I)	110
Eosin NDA—(CN)	10
Onis (Anthosine) 3B—(B)	250
Radio Brown B—(C)	5
Radio Red VB—(C)	25
†Sulphon Yellow R—(By)	201
*Wool Fast Blue BL—(By)	496

Vat Dyes

Grelanone Brown RR Paste—(GrE)	112
Grelanone Violet BR Paste—(GrE)	56
Helindone Printing Black RD Paste—(M)	100
*Helindone Pink B Ex. Paste—(M)	110
Hydron Brown (sgle. stngth.)	8,390
*Hydron Brown G Paste—(C)	
Hydron Brown G Powder—(C)	
Hydron Brown R Paste—(C)	
Hydron Brown R Powder—(C)	
Hydron Pink FB Paste—(C)	500
*Hydron Sky Blue FK Paste—(C)	300
Hydron Wool Yellow G Powder—(C)	50
Hydron Yellow NF Paste—(C)	500
*Indan. Pink B Dbl. Pst. (sgle. stngth.)—(B)	708
Vat Blue IGGSNL Dbl. Pst. (sgle. stngth.)—(M)	10
Vat Blue IRL Paste—(M)	5
Vat Green 12B Powder—(M)	2
Vat Reddish Brown R Powder—(M)	2

Mordant and Chrome Dyes

Acid Alizarine Gray—(Q)	110
*Alizarine Cyclamine R Paste—(By)	398
Alizarine Fast Gray 2BL—(By)	110
Metachrome Blue Black 2BX—(A)	1,500
Metachrome Brilliant Blue 8RL—(A)	10

Direct Dyes

Benzo Fast Brown 3GL—(By)	110
*Benzo Rhodamine Red 3B—(By)	110
*Brilliant Benzo Violet B Powder—(By)	338
*Brilliant Pure Yellow 6G Extra—(By)	441
Celatine Blue—(Q)	336
*Chloramine Light Gray R Conc.—(S)	201
*Chlorazol Fast Brown RK—(BD)	500
Diamine Catechine B—(I)	661
Diamine Fast Blue FFB—(C)	200
Diamine Fast Rubine RF—(C)	100
Diazo Brilliant Green 3G—(By)	520
Diazo Fast Blue 6GW—(I)	220
Diazo Fast Bordeaux BL—(By)	220
Diazo Fast Violet	134
Diazo Fast Violet BL—(By)	
Diazo Fast Violet 3RL—(By)	
Diazo Light Violet BL—(By)	521
*Diphenyl Fast Bronze B—(G)	110
Fast Cotton Gray BL, GL, VL—(A)	400
*Naphthamine Fast Brown BL—(K)	200
Minaxo (Oxamine) Black BBNX—(B)	100
†Polyphenyl Blue GC—(G)	485

Sulphur Dyes

Immedial Brown RR—(C)	220
Sulphide Direct Blue G Conc.—(M)	10
Sulphur Brilliant Blue CL2R—(A)	10

Color Lake Dyes

Hansa Green G Powder—(M)	10
Hansa Orange R Powder—(M)	5
Hansa Red B Powder—(M)	5
Hansa Yellow R Powder—(M)	5
Sudan AB, OB—(A)	6

Basic Dyes

Diphene Blue B—(A)	500
Victoria Blue Base I—(CN)	25

Unclassified Dyes

Azole B, D, R, T—(A)	20
Azole AZ, 6GL—(A)	10
Acetate Brown O, R—(A)	10
Acetate Orange G—(A)	5
Acetate Red A—(A)	5
Acetate Yellow R—(A)	5
Blue 1259—(G)	4
Carthame Rose—(G)	4
Jasmine Yellow G Supra—(G)	4
Turquoise Blue A Conc.—(G)	4
Sky Blue N 43%—(C)	100

Color Lakes of Coal-Tar Origin

Name of Lake	Quantity (pounds)
*Blue Lake 42D	250

Medicinals, Photographic Developers, Intermediates and Other Coal-Tar Chemicals

Name of Chemical	Quantity (pounds)
Amidopyrazoline	224
*Antagol	....
†Antifebrin Compound (oz.)	11
*Antipyrine	1,453
Azole Developer ON	5
†Benzoic Acid	11

(*Concluded on page* 636)

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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OPTIMISM PLUS FIGURES

WHEN the American Woolen Company voted to pass the regular quarterly dividend on its common stock, when the B. B. & R. Knight Corporation withheld the interest on its bonds, many said these actions indicated that a revival of business was not "just around the corner," as the statisticians had predicted. Regarded superficially, both of these actions apparently point to continued dullness in trade. But regarded economically, they point back rather than forward. They are but an aftermath of a prolonged depression. While industry slumbered no outward sign revealed the crisis which held it down. But now some of the old spirit has returned. Now a movement here, a movement there, forecasts a nation-wide awakening. At such a time it is but natural that some indication of what industry suffered during the depression should manifest itself in the form of passed dividends and interest payments.

August trade statistics refute the pessimism that prevailed during the summer. Demand is developing rapidly and production must follow. The United States Steel Corporation reports that the rate of new orders in the first three weeks of August was 10 per cent greater than the rate for July. From the automobile industry comes word that the general expansion is showing its effect in increased buying capacity. Building construction, a notable exception during the slack period, shows no inclination to diminish. Gains in car loadings for the last week in August show clearly the upward trend of trade. Total loadings passed a million for the first time this year. Crop reports, favorable beyond expectation, are regarded as the most important factor in the business situation at this time of the year.

Speaking of textiles, the National City Bank report states: "The textile industry has been one of the darkest spots in the business situation, but here, too, the effects of reduced stocks are becoming manifest. That there is nothing radically wrong with consumer demand is indicated by an 8 per cent increase in the total July sales of department stores in this dictrict over a year ago. Raw silk has been improving steadily, and broad silk mills have been gradually increasing operations. In New England, cotton mill operations have been on a gradual upgrade since July, and reports recently have indicated increased activity in many mills in this State and in the South which have been closed down or running part time."

An announcement made by the Bureau of Labor Statistics of the Department of Labor declares that employment in textile mills during August showed a gain of 1.7 per cent, compared with a drop of 7.1 per cent in July. Pay-roll totals increased 6 per cent in August, compared with a 9.1 per cent drop in July. "August was the first month since February," says this report, "in which employment, total earnings and per capita earnings in all industries increased over the preceding month." When reports from fifty-two industries were compared and averaged, it was found that exactly one-half showed increases in employment in August, while thirty-five showed pay-roll increases. Only seven increases in employment and only five increases in pay roll were shown in July.

Secretary Hoover a few days ago gave it as his opinion that the situation in the textile industry warrants optimism to an increasing degree. He declared that he was watching for increased production throughout the country because of greatly diminished inventories. A revival of international trade due to the partial untangling of European problems should exert a most healthful effect upon our export and import business with every other country. There is a very evident direct connection between this settlement of foreign affairs and the business situation in this country. A favorable outlook abroad is certain to augment activity in our domestic staple industries.

Some conservative skeptic may pronounce many of these signs of business recovery as merely an exaggerated mental reaction from the gloom brought on by the depression, rather than as indications of a material advance in trade. But facts are facts and figures are figures, and it is a sound economic law that when the pendulum of industry makes a long downward swing there must follow a corresponding curve upward. By the same law, when one unit makes a spurt others follow and the race is on. While hand-to-mouth buying is still prevalent to some extent, those who practise it will soon be forced into a more confident state of mind when increased demand makes itself evident in their business.

Because the mills are turning out larger quantities of merchandise, correspondingly larger orders should very soon appear in the dyestuff and chemical market. Some manufacturers may be tired of hearing that theory expounded with such persistence, but when it

is soundly supported by figures they can do little else than accept it. Meanwhile, those who see its economic significance are out after orders—and getting them, too.

RECENT LITERATURE

1924 Year Book of the National Association of Cotton Manufacturers combined with the Cotton Manufacturers Manual.

This publication will be found of great value and interest not only to cotton manufacturers but to many others interested in the textile industry. The publication is divided into two parts, the first being the Year Book of the association, containing 86 pages and giving a list of the officers and classified lists of the various types of members both alphabetically and geographically. The second portion includes the Cotton Manufacturers' Manual, which is divided into the statistical portion, containing 149 pages of extremely valuable and useful statistical information in regard to cotton production, consumption, exportation and cost for the past year and over a period of years. The second sub-section is of a technical character, consisting of 70 pages of useful tables and information in regard to measures and weights, counts of yarn, specific gravity, various standard units and data for making any calculations of value to the cotton manufacturer.

Manual of Standard Practice for the Power-Laundry Washroom. By the Department of Research of the Laundryowners' National Association, Mellon Institute of Industrial Research of the University of Pittsburgh. 187 pages. $1.50.

The second edition of this book has just been issued. For those who failed to obtain a copy of the first edition a word or two regarding the nature of the book should be interesting. As the title imples, it was issued by a laundry owners' association for laundry men. But it must not be inferred that its value is consequently confined to the laundry field. A book that covers, among other subjects, water softening, alkalis, soaps, bleaching, sours, blues, starches, temperature, pipe corrosion and heat insulation, should command the interest of every textile chemist.

The book is intended not only for careful reading and study; in the chemist's library it will also be useful as a handy ready-reference work when questions arise concerning the subjects with which it deals.

In the foreword the statement is made regarding the book, "that it is the result of eight years of careful and scientific investigation. . . ." A mere hasty perusal of its contents ably supports this statement, and compels admiration of the concise manner in which a large quantity of material has been presented.

The chapter on "Water" defines the term "hardness," explains why soft water is desirable and why a water softener is required to meet certain conditions; describes the operations of the types of softening plants in use—the lime-soda ash type, the zeolite, and the combination zeolite-and-lime installations—and concludes by recommending the zeolite type for laundry purposes, briefly outlining the reasons for the recommendation and explaining how samples of water should be submitted in presenting individual water-softening problems. Included in this chapter, as well as in several of the others, is a section headed "Experimental Part for the Student," which gives formulas and directions for making tests and experiments along the lines of the subject treated in the chapter, and lists questions to be answered concerning the experiments made. The chapter concludes with two pages of analytical notes: "Determination of Hardness of Water by the Soap Test," "Determination of Total Hardness," "Permanent Hardness," "Temporary Hardness" and "Standards of Hardness."

The chapter on "Alkalis" begins by telling exactly what an alkali is and why alkalis are used. The effects of alkalis on textile fibers in general and on cotton thread in particular in contact with air are explained. Silicates and bentonite as detergents are described and the choice of an alkali summed up thus: "Experimentation along the line presented in the foregoing discussion has led to the conclusion that soda ash is, pound for pound, the most effective alkali of those commercially available, excepting caustic soda, which is recommended for use in special cases only. Potassium compounds are more expensive than sodium compounds. Excepting for minor special cases, their employment is not indicated by reason of economy or conservation of the life of the goods. . . ." This chapter, in addition to the experimental section for the student, has a part devoted to the "Qualitative and Quantitative Analysis of Alkalis."

Soaps are discussed in the third chapter: "Their Manufacturing Principles," "Titer of Soap," "Detergent Value of Soaps," "Use of Low Titer and High Titer Soaps," "Purchase Specifications," "Sampling," "Moisture Determination," "Powdered Soap," and "Pastes." The section closes with a nine-page description of the "Standard Analysis of Soaps."

Bleaching and bleaches are fully treated. One section gives instructions for preparing sodium hypochlorite from chloride of lime and soda ash; another tells of the specifications for bleaching powders; a third, of laundry bleach from liquid chlorine. Formula and instructions are given for preparing a bleach

liquor of about 5 per cent available chlorine strength and a diagram shows the apparatus used. The physical properties of chlorine and the production of hypochlorite from soda ash and liquid chlorine are discussed. The method of making bleach liquor by the electrolytic process is fully described.

Hypochlorite, it is stated, although in use to-day in power laundries for bleaching cotton and linen, may exert powerful effects upon these fibers if its application is not carefully carried out. By a table it is shown that a certain concentration of the bleach results in a heavy percentage loss of tensile strength in proportion as the concentration is increased. These data in regard to loss in tensile strength emphasize the necessity of bleaching as lightly as possible. For this reason the use of perborates and percarbonates as bleaches is cautioned against in conjunction with soap in the concentration given in the table.

The concluding paragraph of the chapter on bleaching treats of metallic dirt, sodium hypochlorite and reducing bleaching agents, and summarizes the results of the discussion. The experimental section gives directions for preparing a soft bleach, describes the tests for determining the effect of the solution and the presence of starch, and supplies exercises in testing the effect of bleach on stains and in general washing. The method for the "Quantitative Analysis of Bleach" is outlined; the preparing of the starch solution, the method of procedure and the analysis of bleach are described in detail.

The preparation and use of sours is next taken up. A part that should be of particular interest to users of sours lists and describes the various sours available in the open chemical market—acetic acid, sodium bisulphite, sodium bisulphate, oxalic acid, sodium silicofluoride and acid fluoride, and acetic-oxalic acid mixture. A brief analysis of sours concludes the treatment of the subject.

In the chapter on "Blues" details are given with a view to assisting the launderer in choosing the blue most suited to his purpose. Ultramarine, smalt, insoluble and soluble Prussian blues, and aniline blues are treated in turn.

The chapter on starches is written around the two types of starches in use, and instructions are given for making thin-boiling starch. The chapter closes with a brief discussion of the relative merits of wheat and corn starch.

The next chapter is entitled "Effect of High Temperature on Cotton Cloth." Ironing and pressing in their relation to temperature effects are explained, and three tables show the results of a series of heating tests on the strength of wool, cotton and silk.

The classification of soiled textiles sent to the power laundry is next taken up in detail with respect to the types of washing methods employed on the various classes of garments and fibers. This is followed by a section devoted to standard formulas for washroom practice. This section will probably be used more for reference than any other for the formulas it contains. Degrees of strength in washing, soaps, detergents, supplies, soda, and rinsing operations are outlined, and the following pages give formulas for the various classifications of work. The book closes with a short chapter on the care of metal washing machines. A very complete index enables the reader to locate quickly any topic treated in the book.

PAPERS DELIVERED BEFORE THE DYE DIVISION OF THE A. C. S.

(*Continued from page* 620)

The Preparation of 2-Amino-Anthraquinone from Phthalic Anhydride and Chloro-Benzene

By Max Phillilps

The preparation of 2-amino-anthraquinone by this process proceeds in three stages: Phthalic anhydride condenses with chloro-benzene in the presence of Al_2Cl_6 yielding chlorobenzoyl-benzoic acid. Chlorobenzoyl-benzoic acid when treated with conc. sulphuric acid yields 2-chloro-anthraquinone, and the latter on heating with ammonia under pressure is converted into 2-amino-anthraquinone. The purpose of this investigation was to determine the optimum conditions for producing the greatest yield of 2-amino-anthraquinone. Using the optimum conditions as determined experimentally the following yields (all computed as per cent of the theoretical) were obtained: Chlorobenzoyl-benzoic acid 78 per cent; 2-chloro-anthraquinone 97 per cent; 2-amino-anthraquinone 95 per cent.

The Catalytic Oxidation of Toluene (By Title).

By C. E. Senseman

The apparatus for the carrying out of this work consists of (1) a carbureter, (2) a reaction chamber, and (3) sublimer. The last two are almost identical with those used by Senseman and Nelson in their "Catalytic Oxidation of Anthracene to Anthraquinone."* Because of the nature of the material the carbureter design was changed from that used in the above-mentioned work. The toluene is dropped from a burette into an electrically heated vertical tube, the temperature of which is kept at approximately 120 deg. Cent.

A rather long series of catalysts has been tried out, the principal ones being vanadium pentoxide and salts of same. Some of the oxidation products are benzaldehyde, benzoic acid, and maleic acid. To date the yields of desirable products have been very low.

A Simplified Autoclave for Intermediates

R. Norris Shreve

It is well known how uniformly and how strong all sizes of steel pipe are now made. With this fact in mind

*Ind. Eng. Chem. (1923), **15**, 521.

a number of autoclaves were constructed out of pipe, using various sizes, and also different designs.

A blue print will be shown giving details of the best design, and a table will be exhibited giving relative costs of this type in comparison with the ordinarily used cast steel autoclaves.

The pipe autoclave adopted was twelve inches inside diameter and had a capacity of about 65 gallons. This was used very successfully in the manufacture of Dimethyl-Aniline and could be equally well used for other products. It was heated by an internal coil through which steam (superheated for higher temperatures) was passed.

Finishers' Troubles in the Textile Industry

Heating of Calenders

Steam Heating of Calender Rolls—Gas Heating of Calender Rolls—"Soft" and "Hard" Heats

By JOHN T. TRAVIS

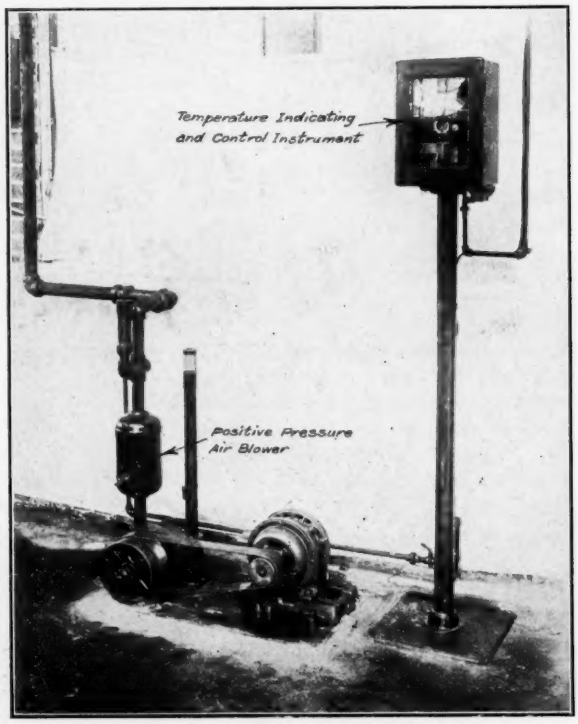
WE are told by scientists that there is a panacea for all our bodily ills, but the main trouble is to apply the exact remedy for any particular ailment.

The same idea may apply in the industrial world. If proof of this were needed, it can readily be found in the many improvements effected during the lifetime of the average person.

Unsatisfactory conditions and results are sufficient evidence that further improvements are possible and necessary, as the development of industry continues.

Steam Heating of Calender Rollers

The main purpose of calendering, is to give to the fabric the firmness of touch required, and to enhance the luster of the yarns of which the fabric is composed.



Courtesy Oriental Silk Printing Co., Haledon, N. J.

Where added "hand" is desired, and finishing solutions are used to obtain the desired effect, heat is necessary for the purpose of "cooking" the finish, while at the same time imparting the luster so much desired.

Many calenders are at present heated by steam, but as there are so many objectionable features to this method of heating, it is hardly surprising to find that many finishers have endeavored to adopt other heating appliances, with more or less success.

The principal objections to the use of steam in heating calender rollers are found in the irregularity of the heat thus furnished, and in the troublesome and inefficient operation of calenders heated in this manner, and the consequent lack of uniform results in the finished fabric.

As many of the steam plants are usually placed to give their most efficient service to the dyer, the finisher may often find his machinery at a considerable distance from the boilers, with the result that on account of excessive condensation, he may be getting "wet" steam of low heating capacity, by the time the service reaches his department.

The variation in steam pressure is another item to be reckoned with, as should a heavy "draw" be made on the boilers, the pressure would be likely to vary in consequence.

At the best, steam as used in most finishing departments is an unreliable agent, and its capacity as a heating medium is very limited.

The question of economy is one of great importance also, as loss of efficiency through any cause is to be reckoned with, and in exact proportion to the loss by condensation, must the cost of the steam service be figured.

The irregularity consequent on the steam heating of calenders is responsible for a great deal of variation in the finished fabric, as it is very easily understood that with variable and inefficient service in the heating of the calender roller, uneven and unsatisfactory results will very naturally be shown in finishing.

Gas Heating of Calender Rollers

Many types of burners have been developed for the

purpose of heating calender rollers by gas, and as the roller must of necessity be heated internally, some difficulty has been experienced in adapting burners which could be depended upon to furnish uniform heat and insure perfect combustion in the restricted area.

As gas cannot be burned satisfactorily in a confined space such as the interior of a calender roller, unless air is furnished in the proper proportion to the gas consumed, air supplied by positive pressure blowers is used, and by this arrangement any desired temperature may be maintained to suit the various qualities of goods to be processed.

By the installation of suitable heat control apparatus, the temperature of the roller is absolutely controlled, within five degrees plus or minus, at any heat desired, assuring uniformity of finish throughout.

This arrangement also prevents any possibility of the fabric being damaged by overheating of the roller, which is liable to occur if the heat control is not installled, where gas is used as the heating agent.

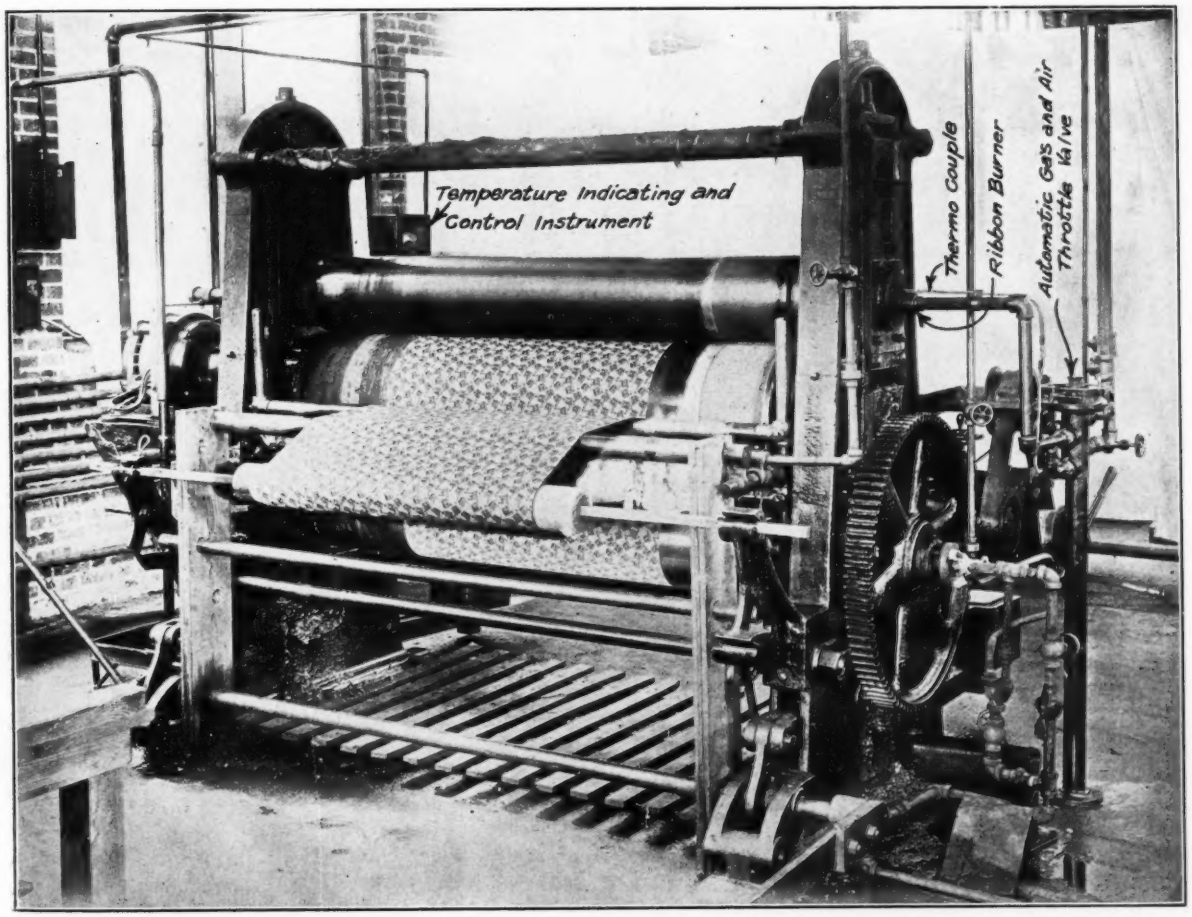
Gas being so much more efficient than steam, it is very necessary that dependable control be had of the temperature to be maintained, as the heat required for finishing is relatively easy to obtain where suitable heating arrangements are installed, but it is of the utmost importance that this heat be maintained uniformly, and be under absolute control.

When steam is used, the entire roller is heated to the same intensity, which causes trouble and annoyance on account of the overheating of the bearings.

When heated by gas, the burners may be so arranged as to furnish heat only to the part of the roller to be brought into contact with the goods, and the ends of the roller are consequently comparatively cooler than the part where the heat is applied. The annoyance of leaky stuffing boxes is also eliminated, as when steam is used, the condensation results in the filling of the roller with water.

Another decided advantage of the heating by gas is the great saving of the time required to heat the roller to a given temperature, as this can be done by gas in considerably less time than required for the heating by steam. Also, any temperature desired may be maintained by gas heating, whereas by steam heating only comparatively low temperatures can be obtained.

(*Continued on page* 641)



Courtesy Oriental Silk Printing Co., Haledon, N. J.

Calendering Machine Showing Burner, Fire End and Regulating Valve

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

PALATINE CHROME RED B

(Schultz No. 202)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Start with Glauber salt and acetic; exhaust with sulphuric and top chrome.

SHADE: Bluish shade of red.

SHADE BY GASLIGHT: Yellower and duller.

SOLUBILITY: Very good.

LEVEL: Dyes level with care.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Cross-Dyeing: Moderate.
Fulling: Fast against white wool and white cotton in moderate fulling.
Ironing: Fast.
Light: Fast enough for men's wear.
Perspiration: Fast.
Potting: Bleeds slightly.
Rubbing: Fast.
Scouring: Fast.
Steaming: Fast; stands one hour's steaming at 30 pounds' pressure.
Sulphur: Fast.
Washing: Fast.
Finishing: Fast.

SENSITIVE TO METALS, LIME: Sensitive to copper; shade is yellower. Sensitive to iron; the shade is destroyed.

MACHINE DYEING: O. K., except in iron machines.

OTHER PROPERTIES: Generally used in combination shades.

DYED BY OTHER METHODS: Dyed chromate, the shade is much duller and the color does not exhaust well but is O. K. for light and medium shades. Chrome mordant: Leaves silk white. Silk-white process: Leaves silk clear.

ON UNIONS: Cotton-effect threads are unstained.

ON OTHER MATERIALS: No interest.

PRINTING: Adapted for printing on slubbing with chrome and Vegetalin, the shade being similar to Anthracene Red (S-355).

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; Central Dyestuff & Specialty Company; Cincinnati Chemical Works; E. I. du Pont de Nemours & Co.; Marx Color & Chemical Company; National Aniline & Chemical Company; Newport Chemical Works (this firm also makes this product in special form for color lakes); United States Color & Chemical Company; Sherwin-Williams Company; Ultro Chemical Corporation; Commonwealth Color & Chemical Company; Palatine Aniline & Chemical Corporation (Selling Agents, F. E. Atteaux & Co.); New England Aniline Works; Grasselli Dyestuff Corporation.

FAST BROWN

(Schultz No. 213)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool and leather.

USUAL METHOD OF DYEING: Acid.

SHADE: Redder and duller than S-211.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Fair.

LEVEL: Does not dye level.

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Cross-Dyeing: Will not stand cross-dyeing.
Fulling: Bleeds badly into whites.
Light: Very moderate.
Potting: Not suitable.
Rubbing: Crocks somewhat.
Scouring: Bleeds off.
Steaming: Will not stand steaming.
Washing: Bleeds off.

DYED BY OTHER METHODS: Dyed on a chrome mordant, faster to milling but no faster to light.

ON UNIONS: Silk-effect threads are stained a bright reddish brown, redder and lighter than the wool.

ON OTHER MATERIALS: Leather: Gives excellent shade on either vegetable or chrome-tanned leather.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Company (Selling Agents, John Campbell & Co.); American Aniline Products, Inc.; Central Dyestuff & Chemical Company; E. I. du Pont de Nemours & Co.; National Aniline & Chemical Company;

Commonwealth Color & Chemical Company; Palatine Aniline & Chemical Corporation (Selling Agents, F. E. Atteaux & Co.); Grasselli Dyestuff Corporation.

AGALMA BLACK 10B
(Schultz No. 217)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Woolen pieces.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Bluish black with a greenish cast.

SHADE BY GASLIGHT: No change.

SOLUBILITY: About 60 grains per liter.

LEVEL: Dyes level in black; not suitable for combination lighter shades.

EXHAUSTS: Clear.

FASTNESS TO:
- **Acid:** Fast.
- **Alkali:** Fairly fast; slight change in shade.
- **Carbonizing:** Fast; no change in shade.
- **Fulling:** White cotton and white silk badly stained; top-chromed, no better.
- **Light:** Best of Acid Blacks except Brilliant Black (S-272).
- **Perspiration:** Not fast.
- **Potting:** Not fast; bleeds somewhat.
- **Rubbing:** Very slight except in very deep shades.
- **Scouring:** Changes shade with soda in hot solution and bleeds badly.
- **Steaming:** Very fast.
- **Sulphur:** Fast; no change in shade but bleeds slightly into white.
- **Washing:** Stands neutral soap at 60 deg. Cent. without change in shade.
- **Water:** Does not bleed in cold water; bleeds slightly in hot water.

SENSITIVE TO METALS, LIME: The color is sensitive to lime.

DYED BY OTHER METHODS: The color is well adapted for cotton-wool unions, dyeing in combination with the benzidine colors, as it goes on the wool in a neutral bath.

ON UNIONS: Cotton-wool unions dyed in an acid bath: The cotton is nearly white. Wool-silk unions: Both fibers are covered equally in a neutral bath.

ON OTHER MATERIALS: Feathers: The color is well adapted for this material. Jute: Dyes O. K. Paper: Good for dyeing the pulp and for calender work. Writing inks: The color is suitable for ink manufacture. Silk: No interest.

PRINTING: The color is adapted for wool printing. Pieces are best printed with oxalate of ammonia.

DISCHARGING: Not recommended for discharge printing, as it cannot be discharged white.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.); American Aniline Products, Inc.: Central Dyestuff & Chemical Company; Cincinnati Chemical Works; Consolidated Color & Chemical Company (Selling Agents, H. A. Metz & Co.); E. I. du Pont de Nemours & Co.; Grasselli Dyestuff Corporation; National Aniline & Chemical Company; Newport Chemical Works; Noil Chemical & Color Works; Passaic Color Company; Sherwin-Williams Company; Commonwealth Color & Chemical Company; Butterworth-Judson Corporation; Palatine Aniline & Chemical Corporation (Selling Agents, F. E. Atteaux & Co.).

PALATINE BLACK
(Schultz No. 220)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool piece goods, hats, etc.

USUAL METHOD OF DYEING: Glauber salt, acetic and sulphuric acid.

SHADE: Reddish black; duller than S-258.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Readily soluble.

LEVEL: Dyes level.

EXHAUSTS: Slowly.

FASTNESS TO:
- **Acid:** Fast.
- **Alkali:** Fast.
- **Carbonizing:** Shade is slightly altered.
- **Fulling:** Stains white wool and white silk.
- **Ironing:** Fast.
- **Light:** Stands fourteen days' exposure without change.
- **Perspiration:** Bleeds into white cotton.
- **Potting:** Color bleeds.
- **Rubbing:** Fast.
- **Scouring:** Stains white wool and white silk.
- **Steaming:** Shade goes greener.
- **Sulphur:** Fairly fast.
- **Washing:** Color bleeds somewhat and stains white.

OTHER PROPERTIES: Best acid black for hats.

ON UNIONS: Suitable for wool-silk unions. Dyed acid on cotton-wool unions, the cotton is left white.

ON OTHER MATERIALS: Silk: Dyed with boiled-off liquor and sulphuric acid, a grayish black.

PRINTING: Of no interest, as the shade produced bleeds freely into white.

DISCHARGING: Discharges white with sulphoxalates, but the discharged effect turns yellow on exposure to the air.

COMPETING PRODUCTS: Made in the United States by Cincinnati Chemical Works.

ANTHRACENE ACID BROWN
(Schultz No. 221)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Top chrome.

(Continued on page 638)

Vegetable Matters Used in Dyeing Cotton Goods

The Soluble Redwoods and Other Dye Woods—Sandal, Barwood, Camwood, Etc.—Logwood

By W. B. NELSON

THE soluble redwoods, redwood, brazilwood, sapan, Lima and Pernambuco woods are all obtained from the trees of the genus Cæsalpinia belonging to the natural order Leguminosæ. It is customary to import these to this country either as liquid extract in barrels or as sticks or logs of red color externally, but nearly colorless inside and varying in size considerably; they have a slightly bitter taste and an aromatic odor and freely color the saliva if bitten. The wood is usually crooked and knotty as it grows in dry and rocky places. Brazilwood grows in the forests of Brazil and may be considered the best of this class; hence we shall write about this alone and our remarks will take in all the others. All these woods give the same shade of color, either if employed alone or with mordants, so from this we may conclude that they contain the same glucoside, which is decomposed into the same saccharine matter and coloring principle by peculiar ferments.

The coloring principle, or rather the color-giving principle, which appears to govern all these woods alike was first obtained from brazilwood by Chevreul, who gave it the name of brazilin. It forms needles which are near ly colorless, and which have a bitter sweet taste. According to researches by E. Kopp, the formula of anhydrous brazilin is $C_{22}H_{18}O_7$. He also finds that the crust contains much brazilin and brazilin lime lake. If the lime is removed by hydrochloric acid and then boiled with a mixture of eight parts of water and one part of alcohol, brazilin crystals are obtained on cooling.

Sapan wood, i. e., the extract, if treated with nitric acid, yields styphnic acid which is the same as trinitroresorcin produced by nitric acid on resorcin. If sapan wood is fused with potassium hydrate it will produce resorcin; at the same time there is produced pyrocatechin, which is also a crystallizable substance, sappanin, to which is assigned the formula $C_{12}H_{10}O_4$-$2H_2O$. It possesses no characteristics and is hardly worth mentioning.

If we expose to the atmosphere a solution of brazilin it becomes a brilliant red color and is oxidized slowly to brazelein; it is possible to hurry this action by heat and the presence of alkalis. If the solution is allowed to evaporate it will deposit beautiful red needles. A crystallized brazilein is obtained from brazilin in the same manner that haematoxylin is made from haematein. It is found that brazilin dissolves freely in alcohol, ether and water. It can be easily reduced to colorless brazilin if its solution with bisulphate of soda is boiled. If bichromate of soda or chrome is added to a solution of brazelin the liquid gives off a dark color, while a very dark crimson lake separates, this a compound between oxide by chromium and brazilein. This is an unstable compound and is easily decomposed by hydrochloric acid. This may serve to illustrate the action brought by bichromate of soda when these woods are dyed. According to the quantity of brazilin or brazilein it contains a solution or decoction of these woods becomes orange or yellow when an acid is added, and by the aid of heat the conversion of brazilin into brazilein is hastened and it is the latter compound which the dyer wants. It is possible to effect the change much more rapidly by the addition to the mixture of bichromate or chlorate of soda. If an alkali be added to a decoction of the wood a beautiful crimson red is produced which varies in shade as the two principles predominate. The following are the reactions of these matters:

Acids—Turns them yellow, more or less.
Alkalis—Turns them crimson.
Chromate of potash (or soda)—Dark red, turning to crimson.
Neutral acetate of lead—Red.
Sub-acetate of lead—Bluish.
Salts of iron—Purple.
Salts of tin—Red.
Salts of alumina—Red.

These are used mostly to get pinks and reds in steam styles in calico printing. They are used in calico print styles, except in topping or mixtures in dveing.

To obtain a good soluble extract it is necessary that the woods be ground up very finely because they deliver their coloring matters to water quite slowly; they are like logwood in this—that they should be well fermented before being treated with water, but not so much—and the quicker they are evaporated after the fermentation the brighter colors will the extract make. A ton of sapan wood usually makes about 145 gallons of 7 deg. Tw. extract.

If the wood is finely rasped it no longer gives any coloring matter if it is allowed to lie in the bright light. A good way of fermenting the wood is to add four pounds of gelatin to every cubic yard of wood (i. e., ground wood); dissolve the gelatin first in cold water and allow the whole to ferment for a few days.

As we have before stated, all these colors are more for printing steam colors to-day than dyeing. To effect this,

the brazilwood (or redwood) reds, acetate of alumina (or aluminum salts) chloride of tin, oxalic acid or acetate of copper is added to the extract and printed on prepared cloth and then steamed. The colors are made faster by the addition of a little sumac extract to the solution. The goods are used also in conjunction with quercitron bark extract in cheap Garoncine styles. Alum throws down a bulky red precipitate. This substance and chloride of tin are the proper mordants for the redwoods, but it must be remembered that all of the colors obtained by these woods are very fugitive and that they lose their brilliancy on a short exposure to the atmosphere.

Sandal, Barwoods, Camwoods, Etc.

These woods are very hard and give a very weak decoction in cold water. They are derived from the genus Pterocarpus, which are found in both the Old and New World. They consist of large billets of wood which have a dull, murky red color; alcohol dissolves out about 16 per cent of them.

Barwood dissolves out about 23 per cent by means of alcohol, and camwood is about the same as the other two. All three of these woods possess the same coloring principle, a principle which is developed by aging; it is found only in the trunks of the trees.

The coloring substance of these three woods is very slightly soluble in hot water and is quite insoluble in cold water; but it is soluble in ether, alcohol and acetic acid. It is to albumin that the latter solvent yields its coloring matter. This is an important matter and may one day render it useful in regard to casein. The coloring matter is freely soluble in solutions that are alkaline, giving a violet red; the acids precipitate this on the cloth in red flakes.

Sandalwood is largely employed to bottom woolen cloth that is afterward to be dyed indigo blue; a fine blue is produced by this called the *"bleu de Nemours,"* this blue having a purple blue by reflected light. It also imparts to cotton and woolen goods a dark red color, which is changed to a dark brown by bichromate of soda (or potash). With sumac it produces dark browns, and with fustic light browns.

Barwood imparts to cotton goods brilliant red shades known as mock Turkey reds. They are not so fast or so bright as real Turkey reds and are easily detected by yielding their color to soap and taking on a purple hue. To get the color right the goods are worked some time in a hot solution of sumac, the same as for the production of black, then in a solution of protochloride of tin, then in hot and cold water, and finally dyed like madder (rope fashion) in a ground barwood bath. It is used with other woods in dyeing woolens, etc.

Camwood is used in a similar manner to barwood and is thought by many to be better in every way than the above, but it differs somewhat from this matter in the two following reactions:

Salts of lead—Bright orange precipitate.
Salts of alumina—Beautiful red coloration.

An alcoholic solution of santal and barwood give the following reactions:

Gelatin—Brownish yellow flocculent precipitate.
Soluble alkalis—Dark crimson or violet.
Sulphuric acid—Heightens the color to a brownish red.
Salts of alumina—Render the liquid turbid.
Persalts of copper—Brownish red coloration and precipitate.
Sulphuretted hydrogen—Yellow opalescence, precipitate redissolved by the fixed alkalis, the liquor acquiring a dark vinous hue.
Distilled water added in large quantity—Same as sulphuretted hydrogen.
Acetate of silver—Brownish red precipitate.
Tarter emetic—Abundant cherry colored precipitate.
Proto salts of iron—Violet coloration and abundant violet precipitate.
Persalts of iron—Intense brownish red coloration and precipitate.
Murcuric chloride—Bright red precipitate.
Salts of bismuth—Solution of a bright crimson red.
Lime water—Abundant reddish brown precipitate.
Protochloride of tin—Blood red precipitate.
Bichloride of tin—Brick red precipitate.
Salts of lead—Dark violet gelatinous precipitate.
Sulphate of zinc—Bright red flocculent precipitate.

In dyeing barwood reds, for which the aforesaid dyestuffs are most suitable, a great deal of skill is required. The dyer must know the precise time to take the goods from the beck, otherwise he may either have the color poor or he may have the goods too brown, owing to having them in too long. It is not, in any case, a poor dyer who can turn out good barwood reds.

In dyeing with this wood (barwood) it is necessary that the goods be in contact with the ground wood: the particles of wood must mix with the fiber; therefore, the goods *must* mix with the wood in the dyeing bath—there must be no loose mordant on the goods.

Quercitron, Fustic, Osage Orange, Wild, Etc.

We will now devote ourselves principally to a consideration of some of the most useful and important yellow coloring matters used by dyers and calico printers; among the most valuable of the yellow dyes is quercitron, the inner bark of a peculiar species of oak, called the *Quercus nigra,* or *tinctoria.* The tree is mostly found in Pennsylvania, Georgia and North and South Carolina. The other matters mentioned above, i. e., fustic, Osage orange, wild, etc., are used in the same manner and for the same purpose usually, and if there is any difference it will be spoken of when we come to it. All these are included in the name quercitron.

The bark is removed from the trees, and after being dried is ground between millstones. The bark is valued

according to the depth of its color and the fineness of the powder that is made from it; for it must be remembered that the woody fiber of the bark contains but a small portion of the coloring principle and that it is not easily reduced.

A newly prepared decoction of the bark is of a transparent dull orange red color, but it becomes, after a time, turbid and gives down a deposit of a yellow crystalline character. The liquor at the same time becomes gelatinous and a blood red color, and it is plain from this that the glucoside has, in some way, become decomposed by some ferment; therefore, like many other wood dyestuffs, it must be used as soon as made. A freshly made solution of these dyewoods should give the following reaction:

Lime water—Deepens the color and gives a brownish yellow flocculent precipitate.

Alum—Brightens the solution, forming a slight precipitate.

Acetate of lead—Thick brownish yellow flocculent precipitate.

Protochloride of tin—Yellowish precipitate.

Alkalis—Deepen the color.

Bichloride of tin—Yellowish precipitate.

Acetate of copper—Olive green precipitate, the liquor becoming yellowish green.

Acids—Brighten the liquor and give rise to a brown flocculent precipitate.

Acetic acid—Decreases the intensity of the color, but if the liquor is turbid it renders it clear.

Salts of iron—Color the solution green and afterward give an olive brown flocculent precipitate.

Gelatin—Gives a reddish flocculent precipitate.

Chlorine—Abundant flocculent precipitate. An excess of the reagent decolorizes the liquor.

The quantity of tannin combined with these woods makes them very useful for olives, goods impregnated with iron and then passed through bark or its woods take on a beautiful olive. The proper mordant for this dye is pyrolignite of alumina. Alum and chloride of tin also make an excellent mordant. When dyeing greens upon cotton cloth the goods are impregnated with pyrolignite of alumina, and then put through a decoction of bark, but when dyeing *light* greens much attention must be paid to the preparation of the decoction. This is made by pouring boiling water on the bark. If deep dark greens are wanted, this method is the best, but if light greens be wanted, the water should not be above 86 or 90 deg. Fahr.; at this heat there is only the finest yellow matter dissolved, but by higher temperature the tan and other matters are dissolved, and the color thus obtained becomes more or less brown. This peculiarity, however, makes it a better ingredient for browns, olives, etc. All "barks" referred to above are used in the form of extracts.

The coloring matter of these woods is quercitrine and is the oxide of a colorless base and a decoction of these barks or woods standing until it becomes stale loses much of its dyeing properties. The yellowish coloring matter is deposited and what remains is of a darker hue, and gives a dull color when used for dyeing.

For woolen and mixed goods flavin, which is made from quercitron bark by some acid, is chiefly used. When dyeing pieces of woolen goods of 22 or 23 pounds weight, the process and proportions are as follows: For each piece two pounds of alum and one pound of tartar are put into a vat containing sufficient quantity of boiling water, and flavin added to the shade desired. The mixture is boiled for a few minutes, a pint of nitrate of tin per piece is added to raise the color and the pieces are put in the vat and boiled for an hour. Mixed goods are dyed twice, the wool as above, and the cotton cold on a sumac mordant, but flavin is not much used now. The following are the mixtures used on the barks, etc.:

Chrome mixture—40 pounds bichromate soda; 40 gallons water; 10 pounds soda. Boil.

Stannate of soda—30 pounds stannate; 40 gallons water. Do not boil.

Yellow prussiate—28 pounds yellow prussiate; 40 gallons water. Boil.

Alum—31 pounds alum; 40 gallons water. Boil.

Vitriol—10 quarts oil of vitriol; 40 gallons water. Cold.

Catechu—450 pounds catechu; 90 pounds vitriol (blue); 400 gallons water. Boil up the catechu first until dissolved; then add the blue vitriol (sulphate copper) until dissolved; then settle.

Iron Mixture No. 1—43 pounds neutral nitrate of iron; 40 gallons water. Cold.

Iron Mixture No. 2—33 pounds copperas; 31 pounds alum; 40 gallons water. Boil.

Quercitron or bark solution—36 pounds bark; 40 gallons water. Boil until dissolved and use at once as it will not keep.

In dyeing yellow cotton bleach the goods, and by running in sumac and stannate of soda, dye with bark and raise with bichloride of tin. In dyeing dark green cotton wet the goods out in sumac and lay overnight. Run twice in iron liquor No. 1 full strength, adding one pail over fourth seam. Run once in soda ash and wash well. Run twice in yellow prussiate, five pails to start and one quart of vitriol standard; add one pail of prussiate and one quart of vitriol (standard) to every third seam. Wash well and squeeze. Run twice in bark, five pails to start, one pail on third seam. Run twice on iron No. 1, four pails to start and one pail on fourth seam (cold). (Iron is always cold.) Wash well and dry.

Dark olive (brown shade). Wet the goods out in hot water. Run twice in bark, full strength, freshen on second seam. Run twice in iron full strength, freshen on fourth seam. Wash and repeat. Wash well and squeeze.

Dark olive (green shade): Same as last but use iron No. 2.

Fast Tan: Wet unbleached goods in hot water. Run once in cutch cold, six pails to start; freshen with one pail on third seam. Run once in cold chrome, two pails

to start; freshen one pail on third seam. Wash; run twice in bark cold, eight pails to start; freshen one pail on fourth seam. Wash and finish.

This tan can be modified by finishing off with alum to make it yellow, chrome to make it redder or copperas to make it darker, or a mixture of copperas and alum as given in the standard solutions. In any case this tan is of great fastness.

Good shades of light olives can be dyed with bark and raised with copperas and alum. All kinds of browns with bark and cutch, raising with chrome, iron, copperas, alum, etc., and maroons, by adding hypernic and raising with various tin spirits, plum spirits, etc. In the hands of a competent dyer quercitron bark is one of the most valuable dyestuffs we have and is capable of producing with other dyestuffs a large range of useful colors which are very fast.

Logwood

Under this head quite a different class of red, purple and black colors will be described, and though they are similar to those already mentioned, are from trees that have attained a considerable size and are called dyewoods in general commerce.

Except for black the coal tar colors have of late years taken their place. Logwood stands at the fore as being of prime importance on account of the excellent black which it produces. Campechy logwood is obtained from a large tree of the leguminous family and called by the botanist *Haematoxylin campechianum* and grows largely in the West Indies and South America. Campechy wood was the best, but of late years the supply is about exhausted.

Erdmann examined it and named it haemetoxylin, and it is by this name that it is generally known. In cold water it is only slightly soluble. It is more soluble in hot water and is readily soluble in ether, alcohol and bisulphide of carbon. Haematoxylin combines with three molecules of water and forms a crystalline hydrate which retains one molecule at 212 deg. Fahr. The formula of these may be expressed:

Crystalline hydrate .....$C_{16}H_{14}O_6.3OH_2$
Monohydrate .....$C_{16}H_{14}O_6.OH_2$
Haematoxylin .....$C_{16}H_{14}O_6$

It assumes a purple color if exposed to the action of oxygen, especially if alkali be present, and is converted in the haematein. Haemateate of ammonia is produced in four-sided prisms; these, however, lose their ammonia at 212 deg. Fahr. It is impossible to reconvert this substance from an alcoholic solution. Alkalis, including ammonia, dye it a fine violet blue. It is easy to reconvert it into haemytoxylin by boiling its solution with sulphurous acid or with zinc and sulphuric acid, or by the help or sulphuretted hydrogen. It will be seen from the following equation how haematoxylin can be converted into haematein:

$$C_{16}H_{14}O_6 + O = C_{16}H_{12}O_6\text{-}H_2O$$
Haematoxylin Haematein

If quite pure haematoxylin is entirely white; in this state it enters freely into combination with alkalis.

The oxidation under the influence of alkalis and the resulting oxidation of haematoxylin is so quickly performed that it is often used as a test for carbonated lime in natural waters, and it is well known among a number of dyers that a better shade of black is produced in carbonated waters because it accelerates the conversion of haematoxylin into haematein and because it facilitates the oxidation of the iron mordant and fastens it upon the fiber, the iron giving little or no coloration in the protoxide form. Logwood is sparingly soluble in cold water and it is only soluble in hot water to the extent of about 3 per cent. It has only a pale yellow color with water if distilled, but it has a blood red color with water that is calcarbareous. A watery solution of haematoxylin gives the following chemical reactions:

Sulphuretted hydrogen—Becomes yellow and then decolorized.

Lime water—Blue precipitate.

Alum—First becomes yellow, gradually changing to wine color and violet, and then gives purple precipitate.

Salts of lead—Very dark violet precipitate, more blue than red by reflected light, and more red than blue by reflected light.

Bichromate of potash (or soda)—Black coloration.

Beak acids—The color changes to yellow.

Concentrated acids—The color changes to red.

Soluble alkalis—Color it a reddish purple which becomes bluish violet.

Neutral salts of lime—Color the liquid purple or violet, magnesia or baryta.

Salts of zinc—Dark reddish purple precipitate.

Chloride of mercury—Orange red precipitate.

Salts of gold—Orange precipitate.

Nitrate of bismuth—Violet precipitate of great beauty.

Salts of iron—Blue black precipitate.

Salts of copper—Dark blue or violet precipitate.

Salts of tin—Violet or blue precipitate.

It is more than probable that the coloring principle in haematoxylin exists in a state of a glucoside, for at the time the trees are cut down the wood is clear and whitish, but by the time the woods arrive in this country they are yellow, with the outside a red color. There is no doubt that the haematein becomes fully oxidized at the expense of the haematoxylin; it is the former that the dyer wants, and therefore the complete oxidation of the glucoside into haematein is necessary. This idea is carried out by the complete rasping of the logs into a coarse powder, and after moistening it it is laid on beds 20 feet long, 12 feet broad and 3 feet thick. A slow fermentation ensues during which the glucoside is decomposed and the haematoxylin is set free. It is necessary that the beds should be frequently turned so that the wood will not get too hot and the coloring matter completely destroyed.

If the logwood is prepared in this way it is used directly to procure blacks, and to prepare the extract used in dyeing and printings. The extract for the market should not be highly oxidized and should be slowly concentrated at a low atmosphere (not over 150 deg. Fahr), for if a high temperature obtains, the haematein undergoes another change through further oxidation and is converted into a dark resinous substance which is of no value. Logwood and its extract is much used for producing cheap blacks on mixed goods, in which the warp is cotton and the filling woolen. The goods are dyed in a bath composed of logwood, sulphate of soda, and bichromate of potash (or soda). A black so obtained is the fastest black known (that can be dyed with logwood). Part of the oxygen of the bichromate oxidizes the coloring principle and the sesquioxide of chromium which is thus produced becomes fixed on the fabric and acts as a mordant.

In addition to dyeing blacks it is also used in dyeing grays, i. e., purple shades of gray with salts of alumina. It is also used largely in dyeing silk and cotton, as well as silk alone.

A good, cheap logwood black that is fast and will not stain white goods when hot pressed, especially suitable for coat and other linings, may be dyed by padding the *scoured* or *bleached* goods with a liquor composed of 125 gallons of water, 110 pounds logwood liquor extract at 51 deg. Fahr., five gallons acetic acid No. 8, run once hot on a two-box dyeing machine or twice on a padder and dry up; then chrome on a single box drying machine in a liquor made up of 125 gallons of water, 49 pounds of bichrome of soda, 3 pounds soda ash. The goods are then run through a steamer and washed. This washing must be very thorough.

The above process of padding, drying, chroming, steaming, washing and drying may be made continuous by gearing all the machines together in line.

With linings a fine silky feel or scroopy finish is desirable. This is only obtained if the goods are fully bleached or at least fully scoured before dyeing; without this the goods will be "fuzzy." Singeing is quite essential for the best results. There are many ways of dyeing black with logwood and chrome that give a good black, are easy to do and comparatively simply and well liked, but they will not stand the light. *All* chrome blacks will turn brown in time whether exposed to the light or not. The best, or at the least one of the best blacks, may be produced by dyeing the goods first on iron buff with nitrate of iron and soda, washing and dyeing with logwood and fustic, and finally topping with copperas.

The best black with logwood is dyed with a tannin bottom. The goods are steeped in a bath of sumac (hot). Myrobalans, cutch, etc., will do but are not so good. The goods are steeped overnight, or, until they are comparatively cold in the sumac. They are followed (see sumac) in the morning by an iron bath, then lime, or chalk, washed, then dyed in logwood or logwood extract and bark.

Cotton may be dyed in two baths or rather two runs, each 20 per cent logwood extract, 4 per cent copper sulphate, 4 per cent soda ash..

When dyeing wool black with logwood the proceedure is as follows:

Bichromate of soda..... 4 per cent
Sulphuric acid .....1½ per cent
Boil for 1½ hours

This liquor should be well exhausted. The wool is now washed with luke warm water, then with:

Logwood extract .....15 per cent
Anthracene Brown W Paste.... 1 per cent
Boil 1½ hours

If we wish to determine whether the third bath is necessary, take a handful of the wool which is now black and put it into a pint of water. If the water reddens, the third bath is required, for the red comes off the wool when attacked by an alkali and fastens on the white during the washing and fulling process. The third bath is:

Bichromate of soda.....1 per cent
Boil one-half hour.

This bath strips off any part of developed logwood. It is the bath which proves the foregoing operations have been correct, for if the mordanting bath has been faulty the color will strip off the wool to a certain extent. If every care has been taken we now have a logwood black that will stand up against white and against fulling. We have said before that chrome has such a powerful affinity for cotton that it never can be got out of it again, and that in time it will destroy the color of the logwood and the goods will turn brown and possibly tender, and this no matter how well the goods may be washed or otherwise neutralized. The writer advises against the use of chrome (except in the case of wool) in the dyeing of logwood black. Logwood may also be used with other natural dyewoods for dyeing a large variety of shades: gray, dark brown, dark maroon, brown and the alum or plumb tub.

[EDITOR'S NOTE.—*This is the second of a series of articles dealing with the vegetable dyestuffs used in dyeing textiles. The author is an experienced dyer and colorist of "the old school" and his writings will no doubt prove of interest to those who are still using the older natural dyes.*]

DYES IMPORTED THROUGH THE PORT OF NEW YORK DURING AUGUST

(*Concluded from page* 624)

Name of Chemical	Quantity (pounds)
Benzoyl Chloride	22
†Beta-naphthol	10
†Caffeine Sodium Benzoate	11
*Colcichine Salicylate	....

Name of Chemical	Quantity (pounds)
Cresidine	1,543
†Creosote Carbonate	1
†Diamidophenol	55
Enesol	....
†Epinine (c.c.)	70
†Epinine Hydrochloride	....
*Guaiacol	....
†Homatropine Hydrobromide	....
Homatropine Hydrochloride	....
Imitation Amber	262
*Lithium Benzoate	1
Methylparamidophenol	500
*Naphthol Solution	33
Naphthylaminesulphonic Acid	5
†Neocaine, Pure	....
Nitrobenzene	110
Paranil CF	5
Phenol Formaldehyde	1
†Physostigmine Salicylate	....
†Pyro Developer	4
*Quinine Salicylate (oz.)	3
*Saponine	....
†Sodium Benzoate	11
Sodium Iodide and Guaiacol (c.c.)	2,400
Sod. Iodide Salicylate and Colcichine (c.c.)	48,360
Sodium iodide and salicylate (c.c.)	46,440
†Sodium Salicylate	72
*Sodium Salicylate and Potassium Bicarbonate	....
†Sulpho Treparsenan	....

SUPPLEMENTARY LIST OF CLASSIFICATION OF DYES

For March—

*Vat Brown RRT Paste
*Vat Green GG Double Paste
*Vat Green G Double Paste
*Vat Brilliant Blue R Paste
*Vat Orange RRT Paste
*Vat Golden Orange Double Paste
*Vat Red RK Paste
*Anthra Yellow GC Paste
*Anthra Yellow GC Powder
*Anthra Bordeaux R Paste Fine
†Cotton Red 4BX
†Rhodamine B Extra Base
†Victoria Blue B Base
*Acid Violet 6 10B
*Anthracene Blue SWGG Powder
*Vat Pink B Double Paste Fine
*Vat Brilliant Violet RRP Powder
*Vat Orange RRT Paste Fine
†Poseidon Blue BGX Conc.
*Brilliant Indigo B Paste

For April—

*Vat Red R Extra Powder
†Benzo Fast Yellow RL
*Diazo Brilliant Green 3G
*Vat Red RK Paste
*Vat Golden Orange G Double Paste
*Vat Golden Orange RRT Paste
*Hydron Green G Paste
*Diamine Orange B
*Hydron Brown G Paste
*Diamine Fast Brown G
*Diamine Orange B
*Naphthol Black BGN Conc. for printing
*Hydron Brown R Paste
*Diamine Brilliant Blue
*Brilliant Milling Blue FG
*Vat Red RK Paste
*Vat Red RK Paste
*Diamine Fast Brown GB
*Benzo Fast Gray BL
*Vat Brown G Paste

For May—

†Benzo Dark Brown Extra
*Brilliant Benzo Violet 2R
†Benzo Fast Blue 4GL
*Brilliant Sky Blue 8G Extra
†Delta Purpurine 5B
*Vat Brown 3R Paste
†Neptune Blue BGX Conc.
*Indanthrene Brown 3R Paste
*Anthra Yellow GC Paste
*Vat Golden Orange G Double Paste
*Vat Golden Orange RRT Paste
†Alizarine Blue Black B Powder
*Pilatus Chrome Brilliant Violet B
*Anthra Wool Black T Vat Soloid
*Anthra Wool Black 3B Vat Soloid
*Anthra Wool Black CM Vat Soloid
*Anthra Red RT Paste
*Diazo Fast Violet 3RL
*Vat Green BB Paste
*Vat Brown GG Paste
*Vat Corinth RK Paste
*Vat Orange RRK Powder
*Rhodamine 6GDN Extra
*Stone Fast Orange R Powder
†Hydron Pink FF Paste
*Hydron Scarlet 3B Powder
†Coeruline S Powder

For June—

†Alizarine Blue Black B Powder
†Diamond Black P2B Conc.
*Brilliant Benzo Green B
*Alizarine Indigo Green G Paste
†Algol Blue FB Paste
*Vat Golden Orange G Double Paste
*Alizarine Sky Blue B Powder
*Ultra Orange R
†Alizarine Orange RP Paste
*Vat Blue 5G Paste
*Sulphur Brilliant Blue CLB

*Metachrome Olive D
*Guinea Brown 2R
*Eriochrome Azurol BX Conc. 1045
*Modern Green N
*Vat Violet BN Powder
*Ciba Violet B Paste
*Ciba Heliotrope B Paste
*Ciba Scarlet G Extra Powder
*Vat Pink B Double Paste
*Brilliant Benzo Violet 2R
*Alizarine Blue S Powder
*Janus Brown B
*Dianil Pure Blue PH
*Alizarine Indigo Black B Paste
*Anthra Red RT Paste

For July—

*Chlorantine Fast Brown RL
*Vat Red RK Paste
*Ciba Violet B Powder
*Ciba Violet R Paste
*Rosanthrene Violet 5R
*Anthra Red RT Paste
*Alizarine Sky Blue B Powder
*Cyananthrol BGAOO
*Ciba Bordeaux B Powder
*Cibanone Yellow R Powder
†Direct Cutch Brown GR
*Chlorantine Fast Brown RL
*Alizarine Astrole B Powder
*Vat Red RK Paste
†Direct Cutch Brown GR
*Cibanone Yellow R Powder
*Chlorantine Fast Brown 3GL
*Indanthrene Red BN Extra for laque
*Vat Red BN Extra
*Ciba Heliotrope B Powder
*Ciba Bordeaux B Powder
*Cibanone Black 2G Powder
*Kitone Pure Blue V

DYESTUFF TABLES

(*Continued from page* 631)

SHADE: Orange shade of brown.

SHADE BY GASLIGHT: No change in shade.

SOLUBILITY: Fair.

LEVEL: Dyes level with care.

EXHAUSTS: Does not exhaust with acetic.

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Carbonizing: Fairly fast.
Fulling: Fast; does not stain whites.
Light: Excellent.
Perspiration: Fast.
Potting: Bleeds somewhat.
Rubbing: Fast.
Scouring: Fast.
Steaming: Fast.
Sulphur: Not fast; bleeds.
Washing: Fast.

SENSITIVE TO METALS, LIME: Very sensitive to lime; use oxalate of ammonia. Very sensitive to copper and iron, shade goes dull.

MACHINE DYEING: Suitable.

OTHER PROPERTIES: Penetrates well; used in fur dyeing and for hats.

ON UNIONS: Cotton-effect threads are not stained.

ON OTHER MATERIALS: Wool-silk: The silk is yellower than the wool.

PRINTING: Suitable for vigoureux printing.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.; American Aniline Products, Inc.

SUDAN III
(Schultz No. 223)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton; also varnishes and oils.

USUAL METHOD OF DYEING: On cotton: Padded with beta naphthol and developed with amido azo benzol, which gives a garnet shade. This is converted to a brown by after-treatment with copper.

FASTNESS TO:

Acid: Fast to acetic acid; shade is changed by mineral acids.
Alkali: Fast.
Chlorine: Fast.
Fulling: No change in shade; bleeds slightly into whites.
Ironing: Altered, the shade returns on cooling.
Light: Stands fourteen days' exposure.
Potting: Bleeds slightly.
Rubbing: Crocks badly.
Steaming: Fast.
Washing: Bleeds off slightly.
Water: Fast.

ON OTHER MATERIALS: Used in manufacture of varnishes and oil colors.

COMPETING PRODUCTS: Made in the United States by Central Dyestuff & Chemical Company; American Aniline Products, Inc.

The United States Tariff Commission has issued two bulletins containing the reports of the commission to the President concerning the differences in cost of production of barium dioxide and sodium nitrite in the United States and in the competing foreign country. Each contains an appendix proclamation by the President.

Technical Notes from Foreign Sources

Function of Water in Wet Spinning of Flax

A paper presented to the Faraday Society, published in the June, 1924, issue of the journal, deals with the function of water in the spinning of flax by the wet method. The conclusion was reached that it is possible to obtain much finer yarns by the wet-spinning process than by the dry-spinning process. In passing from roving to yarn the proportion of short fibers produced, which is usually a large amount, is considerably modified by the amount of water absorbed by the roving. It is also stated that in the case of both dew-retted and water-retted flaxes the aim should be to obtain the maximum absorption of water by the pectin compounds in the fiber consistent with negligible loss of pectin compounds by solution of the spinning trough in the water.

Mordant Dyestuffs

British Patent No. 197,940 is concerned with a process for the manufacture of mordant dyestuffs. These dyestuffs yield fast, violet-blue shades on chrome-mordanted fibers. They are produced by heating with concentrated sulphuric acid quinone-dianilide compounds which are obtained by condensing para aminosalicylic acid or its derivatives or homologues, with a chlorinated benzoquinone, such as chloranil. Products which yield deeper shades are produced by the introduction of nitro groups into the product, either by the initial condensation of nitroaminosalicylic acid with chloranil or by heating the condensaton product with a mixture of nitric and sulphuric acids (in which case a lower temperature is employed than if sulphuric acid is used alone), or by nitrating the final product.

Determination of Molecular Weight of Silk Fibroin

The molecular weight of the crystalline substance that is contained in silk fibroin was determined by the method of depression of the melting point, using resorcinol as the solvent. After preliminary exhaustive extraction of the silk fibroin with water or alcohol, values of about 200 were obtained. After extraction with the aid of boiling cresol, 314 to 380 and after solution in acid and subsequent neutralization, 350 to 370. None of these methods of purification affected the nitrogen content of the material to a marked degree. *Zeit fuer physiol. Chemie*, 1924, *pages* 296-299.

Oxalic Acid and Formation of Aniline Black

The catalytic action of oxalic acid in the formation of aniline black was described by the author in 1886. The following process has been worked out on a large scale. Dry bleached cotton fabric is impregnated with a cold 6 per cent solution of potassium bichromate The cloth is then dried and thereafter printed with a paste which contains 5,300 grams of starch, 21,000 grams of water, 5,200 grams of gum tragacanth thickening, 2,800 grams of aniline hydrochloride and 980 grams of oxalic acid. The black color on the fabric develops immediately and the whites are subsequently perfectly cleared by soaping. The preliminary bleaching must be thorough, otherwise the white and black portions of the fabric are discolored with reduced chromium oxides. The accelerating action of oxalic acid is ascribed to its reducing power, whereby the unstable chromium oxide, CrO_2, is formed, and subsequently decomposes thus: $4CrO_2 = 2Cr_2O_3 + O_2$. Oxalic acid plays a similar part in the chromate discharge of indigo.

For further details the reader is referred to Revue Generale Matieres Colorantes, 1924, volume 28, pages 126-7.

Agents for Scouring and Dyeing

Agents which are suitable for use in scouring and dyeing at temperatures of approximately 100 deg. Cent. are prepared by mixing hydrogenated hydrocarbons, for example, tetra- and deca-hydronaphthalenes, with alkali salts of soap forming fatty acids or sulphinated oils or sulphonic acids. The resulting emulsions are then incorporated with colloidal silicate, such as bentonite, ehrenbergite, china clay and the like.

For example, a satisfactory scouring agent can be prepared from 30 parts of a fatty acid, 25 parts of decahydronaphthalene, 25 parts of tetrahydronaphthalene or tetrahydro-beta-naphthol, 1 part of a 30 per cent aqueous suspension of bentonite, 10 parts of water and 8 parts of caustic soda, 70 degrees Tw. or 1.35 specific gravity.

It is also stated that such agents are useful as paint removers and for treating metals prior to galvanizing and electroplating (British Patent No. 215,880).

Dyeing Yarns

British Patent No. 216,415 is concerned with a process for dyeing and bleaching yarns in strands, loose material and the like. An apparatus is also described in the patent.

This apparatus, when used for dyeing purposes, comprises an automatic reversing device which is in communication with either of two small compartments above which are two larger vertical chambers which contain the material to be dyed. Dye liquor is continually forced by a pump through a removable vertical filter, then through one of the smaller compartments, upward through one vertical chamber and returns downward to the pump. The direction of flow of the dye liquor through the vertical dyeing chambers is periodically reversed by suitable rotation of the reversing device, but the liquor always flows in the same direction through the filter.

Industrial Chlorination of Wool

An investigation of the applicability of chlorine in the chlorination of wool is described in an article published in Chimie et Industrie, volume 10, pages 636 to 642.

Chlorination of wool is carried out for the purpose of preventing its shrinkage and increasing its dyeing capacity. This investigation is concerned with the availability of dry chlorine gas for this purpose. When the dry wool was treated with dry carbon tetrachloride which contained chlorine, formation of a sulphur chloride took place. This reaction took place between the chlorine and the sulphur that is naturally contained in wool. In fact, it was found that the sulphur content of the wool was reduced from 3 per cent to 2.08 per cent.

An experiment was then made with dry chlorine gas and also with a solution of chlorine in dry carbon tetrachloride. Under these conditions it was found that the chlorinated wool was not discolored in any way and that it retained 4.4 per cent of chlorine. A reaction was obtained at once with starch-potassium iodide in the absence of an acid. Then when the chlorinated wool was afterward washed with benzene, which resulted in the removal of the sulphur chloride, the wool again reacted with the starch-potassium iodide solution in the absence of acid. Then the chlorinated wool was washed for a long time with water, and thereafter it was found to contain 0 93 per cent of chlorine. This time it reacted with starch-potassium iodide only when an acid was added. The chlorinated wool was then given an anti-chlor treatment with a solution of sodium bisulphite and then analyzed for chlorine. The chlorine content was then found to be 0.58 per cent. The total loss in weight that was suffered by the woolen cloth during this treatment was only less than half of 1 per cent.

The conclusion is reached that during the chlorination of wool, stable chloramines are produced, and the hydrochloric acid formed at the same time is fixed by the non-chlorinated amino compounds, substances which have the following type formula: R.CO.NHR.HCl.

When the wool contained moisture and was then chlorinated with dry chlorine, it was found that loss of weight ensued. The formation of hydrochloric acid during this process was proportional to the amount of moisture that was originally found in the woolen fiber. In the case of normal air-dry wool, this loss was established to be 3.15 per cent. On the other hand, the corresponding loss in the case of dry wool was only 0.15 per cent.

The conclusion was finally reached that the loss of weight suffered by wool during the ordinary process of chlorination, in which no special care is taken to exclude moisture, is due to a secondary oxidation of the wool and not to the formation of chloroamines. It was also found that after the wool has been chlorinated by the dry process, it is much more easily wetted out and possesses a considerably greater affinity for acid and basic dyestuffs. On the other hand, it was also observed that the colors obtained on the woolen fabric are less fast to washing. Furthermore, wool which has been subjected to dry chlorination shrinks less than that chlorinated by the wet process. In practical operation of the dry process, it has been found that wool can be dried to a degree suitable to the conditions of dry chlorination by subjecting it to a current of air at a temperature of 85 deg. Cent. for a period of twenty minutes.

Coloring Sewing Cotton

In general, sewing thread is bleached before it is dyed. But because of the great quantity of this product manufactured and the demands put upon the plant, it is customary in the manufacture of black thread or cotton dyed in somber colors to omit the bleaching step in the process. The principal point that has to be watched in the dyeing of thread is to see that the dye liquor penetrates the thread thoroughly.

When the color does not permeate the cotton thread through and through, the dyeing of the thread is imperfect. In order to attain perfect permeation the dyer must employ dyestuffs which possess maximum solubility. It is also important that he add to the color bath, whenever it proves necessary, a certain proportion of a water-soluble oil. In any case, when the thread is twisted or wound up, it is important to see that there are no lighter-colored or uncolored places in it.

Before the dyeing proper it is essential that the strands of cotton are first digested for several hours in water to which a certain proportion of caustic soda has been added. This digestion should be thorough and under certain conditions it is also advisable to add a little soluble oil to the caustic soda bath. This results not only in the dyestuff being made to penetrate into the fibers without any difficulty, but the fibers are also obtained and kept in a soft, hydrated condition.

Very tightly twisted thread, when wet with water, unravels and then the dyeing of the same is rendered very difficult. Hence, it is recommended, in order to avoid this difficulty, that the thread be wound up loosely and dyed in such condition.

In order to enhance the penetration of the dyestuff into the fibers, a dye bath is first used which contains just a solution of the coloring matter in water. Then the various auxiliary dyeing agents, such as common salt, sodium sulphate and the like, are added.

The most important color employed in the dyeing of sewing thread, because more of it is used than any other, is black. For this purpose various developed blacks are used in large quantities, such as Sulphur Black. Greens, blues, browns and fancy colors are obtained with direct dyestuffs or sulphur colors.

Mercerized fibers must be given special treatment so as to avoid the lessening of the luster and also to prevent the fiber from disintegrating during the dyeing process. For this purpose a mixture of saponified Japan wax in an aqueous solution of carbonate of soda is recommended. It is also useful to add a little solubilized starch to the solution. Good results are also obtained from mixtures of beeswax and starch pastes or paraffine wax and gelatine.

This article is taken from Deutsche Faerber Zeitung, 1924, 486.

Artificial Silk Fabrics

British Patent No. 210,484 is concerned with a process for the manufacture of fabrics that contain artificial silk of the cellulose acetate variety.

Natural cellulose yarns in mixed fabrics comprising cellulose acetate yarns and unmercerized or incompletely mercerized natural cellulose yarns are mercerized by treatment at a temperature not in excess of 15 deg. Cent. with a solution of sodium hydroxide of 1.24 to 1.30 specific gravity. The fabric is then squeezed between rollers, stretched, washed, treated with cold, dilute acid, and then washed until neutral. The cellullose yarn exhibits little or no contraction or loss of luster, and very little loss of weight after the treatment. Furthermore, its dyeing properties are also not materially affected. The fabric may contain dyed yarn in either the warp or weft, or in both, and a crepe effect may be produced in the finished article by effecting the treatment without tension on the fabric.

HEATING OF CALENDERS

(*Concluded from page* 629)

"Soft" and "Hard" Heats

The idea has been expressed by some finishers that steam as a heating medium for calenders furnishes a "softer" heat than gas at the same temperature. This is, however, an erroneous impression, and is no doubt due to the fact that gas, being more efficient than steam, might through lack of attention on the part of the operator heat the roller beyond the temperature required.

This, however, cannot occur if a dependable system of heat control is installed, as any variation in temperature would be automatically corrected instantly.

The illustrations show an ideal installation recently made at the works of the Oriental Silk Printing Company, Haledon, N. J.

This comprises ribbon gas burner, with motor-driven positive pressure air blower, and heat control apparatus conveniently installed.

The efficiency, economy and dependableness of this method of heating calender rollers result in satisfactory and uniform production.

INDANTHRENE PRINTING BLACK BR PASTE

H. A. Metz & Co., Inc., have placed on the market Indanthrene Printing Black BR Paste, a new black dyestuff of the Indanthrene class. This brand is printed by the ordinary hydrosulphite and potash steaming process which is now generally used for printing Indanthrene. It may also be very satisfactorily applied by the caustic soda development process. Its fastness to light, washing and chlorine is said to be exceptionally good. The color is manufactured by Farbwerke vorm. Meister Lucius & Bruning, for which H. A. Metz & Co. act as American agents.

GOVERNMENT FILES NEW BRIEF IN CHEMICAL FOUNDATION SUIT

The Government has filed another brief in the resumption of its suit in the U. S. Circuit Court of Appeals to recover the German dye patents, copyrights and processes sold to the Chemical Foundation Company. The case is an appeal from the U. S. District Court of Delaware, which dismissed the Government's suit in favor of the Chemical Foundation. Full details of the proceedings in the Delaware court appeared in the pages of The Reporter at the time of the trial.

This new brief of 500 pages contains a full history of the case as well as the story of the events culminating in the sale of the patents. In its accusations and contentions the Government repeats its principal charges against Francis P. Garvan, President Wilson, Frank L. Polk and other officials involved in the transaction.

The legality and constitutionality of the sale is again questioned and attacked. Part of the brief is devoted to evidence probably intended to compromise dye manufacturers by alleging conferences of these with directors of the Chemical Foundation just prior to the transfer of the patents. It is maintained that the price paid for the patents, held to be "grossly inadequate," was arrived at during one of these conferences. In support of the charge that the price was far below the actual value of the confiscated records, the Government brings forward cost figures intended to show that royalties and license fees for the use of the patents amounted to more than the sale price.

In proclaiming the sale invalid the Government bases its arguments on six points outlined in the brief as follows:

1. That the U. S. District Court erred in holding that executive officials have "unlimited power," under the Trading with the Enemy Act, to dispose of confiscated property as absolute owners.

2. That the District Court erred in ruling that Section 41 of the Criminal Code did not apply to the present case.

3. That there was no lawful authority for the making of the sale to the Chemical Foundation.

4. That the sales were irregular in many particulars and especially in that there was no effort to arrive at the value of the property; the price was nominal and was arbitrarily fixed without reference to value, and was grossly inadequate.

5. The decision should be that the effect of the transaction with the Foundation was the confiscation of property and the grants of subsidies or donations to private industry.

6. That the transactions were made in pursuance of and in the accomplishment of an unlawful scheme or conspiracy.

Francis P. Garvan is the target for a score of accu-

sations and allegations of error in the performance of his duties as Alien Property Custodian and as president of the Chemical Foundation Company. His double role is assailed as a violation of the criminal code, in direct contradiction to the ruling laid down by Judge Morris in the proceedings in the District Court of Delaware.

In answer to the argument advanced by the Chemical Foundation that the entire transaction was under the direction and supervision of President Wilson, the brief asserts that Wilson, busied with more important affairs abroad, knew little or nothing concerning the transfer of the patents; that his appointment of Frank L. Polk as authorized agent in the patent sale, particularly the delegation of unlimited power to Mr. Polk, failed to validate the transaction.

One by one the new brief attacks the points in the lengthy decision handed down by Judge Morris when the case closed in the lower court. No statement of this decision is left unchallenged; the strongest arguments possible are brought to the support of the Government's claims. From the tone of this latest brief it is evident that the case is foredoomed to bear a weight of reiterated testimony pro and con. It is scheduled for trial in Philadelphia during the week of October 8. It is improbable, from the present outlook, and from the persistent attitude of the Government, that any satisfactory decision will be arrived at this year.

APPARATUS FOR TESTING COLORS

A new German apparatus for testing the resistance of colors has been constructed at Hanau in the form of a mercury vapor lamp, according to Consul-General Dumont.

The fading of color being chiefly due to the influence of ultra-violet rays, which are not numerous in the ordinary daylight at low altitudes, the lamp accelerates the process in emanating these rays in considerable quantities. The effect on textiles, for instance, of one hour's exposure to this source of light is greater than that of many hours' exposure to the ordinary sunlight.

The lamp has a quartz glass burner similar to those used for medicinal purposes, and is said to be more powerful than any other model. Mercury vapor, which at high temperature emanates the desired chemically active rays, is contained in an airtight transparent tube of quartz glass and heated by means of electric current. Contrary to ordinary glass, the fused quartz allows the ultra-violet rays to pass freely. It remains firm at a temperature at which glass liquefies. The apparatus consists of a quartz burner and a suspension and tilting mechanism, the latter used in igniting the lamp. It is possible to direct the rays in any direction.—Industrial and Engineering Chemistry.

B. Nagindas & Co., 25-27 Military Square Lane, Fort Bombay, India, importers of paper, chemicals and sizing materials, and mill, gin and store suppliers, desire to make American connections with a view to purchasing chemicals here.

Mr. and Mrs. S. R. David left Boston recently for an extended pleasure trip through the West, and are expected to return around the 15th of October. They expect to visit all the west coast as well as the Grand Canyon, Yellowstone National Park and other scenic points.

Four new leaflets issued by the Department of Commerce, Bureau of Standards, give the United States Government's Master Specifications for writing ink, stamp-pad ink, red ink, and record and copying ink.

YOUNG CHEMIST WANTED

A textile organization in Pennsylvania have a vacancy in their laboratory for a young chemist, preferably one having experience in problems connected with the scouring and dyeing of loose wool and yarns. Good progressive position for the right man. When replying state age, training, experience, and salary expected. Address replies to Box 268, American Dyestuff Reporter.

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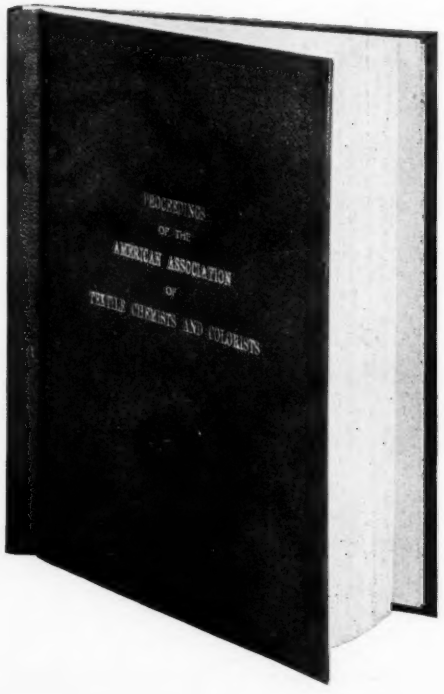

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